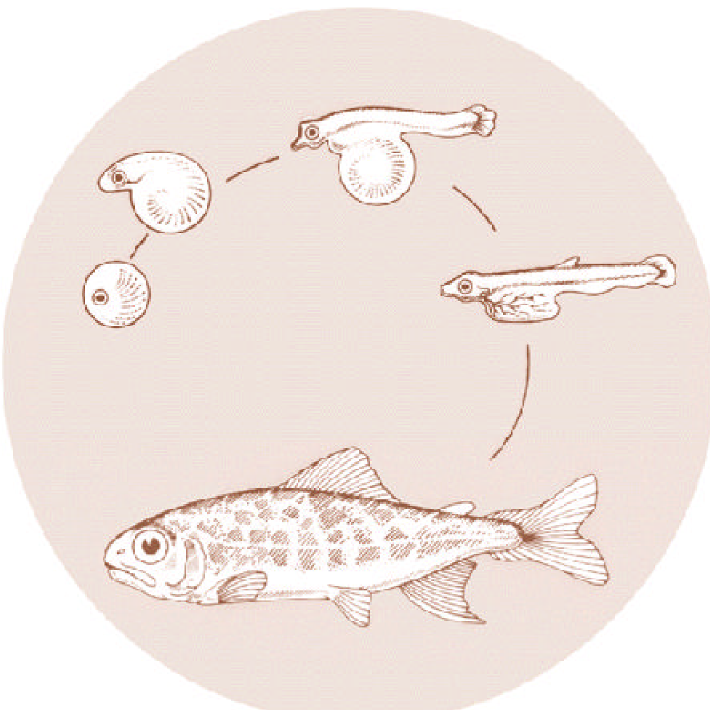
August 1999

IDAHO SUPPLEMENTATION STUDIES

Five Year Report 1992-1996



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FISHERY RESEARCH

IDAHO SUPPLEMENTATION STUDIES

Five Year Report
1992-1996

IDFG Report Number 99-14
August 1999

Idaho Supplementation Studies

Five Year Report
1992-1996

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INTRODUCTION

In 1991, the Idaho Supplementation Studies (ISS) project was implemented to address critical uncertainties associated with hatchery supplementation of chinook salmon *Oncorhynchus tshawytscha* populations in Idaho (Bowles and Leitzinger 1991). The project was designed to address questions identified in the Supplementation Technical Work Group (STWG) Five-Year Workplan (STWG 1988). Two goals of the project were identified: 1) assess the use of hatchery chinook salmon to increase natural populations in the Salmon and Clearwater river drainages, and 2) evaluate the genetic and ecological impacts of hatchery chinook salmon on naturally reproducing chinook salmon populations. Four objectives to achieve these goals were developed: 1) monitor and evaluate the effects of supplementation on presmolt and smolt numbers and spawning escapements of naturally produced fish; 2) monitor and evaluate changes in natural productivity and genetic composition of target and adjacent populations following supplementation; 3) determine which supplementation strategies (broodstock and release stage) provide the quickest and highest response in natural production without adverse effects on productivity; and 4) develop supplementation recommendations (Bowles and Leitzinger 1991).

This document reports on the first five years of the long-term portion of the ISS project (1992-1996, brood years 1991-1995; Figure 1). Small-scale studies addressing specific hypotheses of the mechanisms of supplementation effects (e.g., competition, dispersal, and behavior) have been completed (Peery and Bjornn 1993, 1994, 1996). Baseline genetic data have also been collected (Marshall 1992, 1994). Because supplementation broodstock development was to occur during the first five years (i.e., one generation; Figure 1), little evaluation of supplementation is currently possible. Most supplementation adults did not start to return to study streams until 1997. The objectives of this report are to:

1) Present baseline data on production and productivity indicators such as adult escapement, redd counts, parr densities, juvenile emigrant estimates, and juvenile survival to Lower Granite Dam (lower Snake River).

2) Recommend changes in methodologies and tasks to improve data collection efficiency and utility.

This project is funded by the Bonneville Power Administration (BPA). Cooperators include the Idaho Cooperative Fish and Wildlife Research Unit (ICFWRU), Idaho Department of Fish and Game (IDFG), Nez Perce Tribe (NPT), Shoshone-Bannock Tribes (SBT), and United States Fish and Wildlife Service (USFWS).

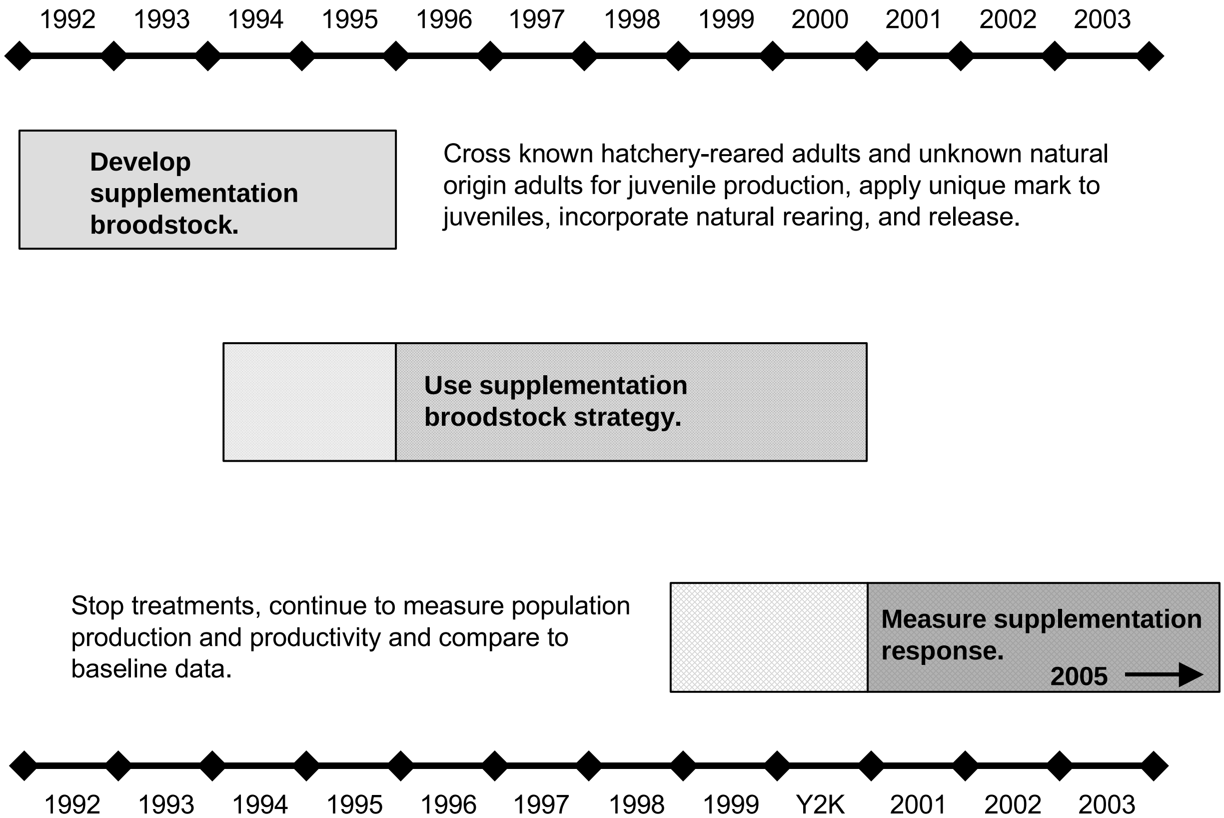

Figure 1. Timeline for Idaho Supplementation Studies

STUDY AREA

Idaho Supplementation Studies represents a statewide research effort incorporating treatment and control streams throughout the Salmon and Clearwater river drainages. The ISS study design identified 12 treatment and three control streams in the Clearwater River basin. Seven treatment and eight control streams were identified in the Salmon River basin. Three control streams have since been dropped from the design due to logistical constraints. These three streams are Johns and Bear creeks in the Clearwater River drainage and Camas Creek in the Salmon River drainage. Eldorado and White Cap creeks (Clearwater River Basin) and the Secesh River (Salmon River Basin) have been added as control streams. In addition, the cooperators realized that low adult returns to Crooked Fork Creek would preclude any opportunity to develop a local broodstock without affecting the natural spawning population. Thus, Crooked Fork Creek was reclassified as a control stream in 1993, after having received only one presmolt release treatment in fall 1992. The Clearwater River basin now consists of four control and 11 treatment streams, while the Salmon River basin includes eight control and eight treatment streams (Table 1, Figure 2). Data collection responsibilities were divided among cooperative agencies (Table 1).

Fish communities are relatively similar throughout the study streams. Anadromous fish include wild, natural, and hatchery-produced spring/summer chinook salmon and summer steelhead *O. mykiss*. Sockeye salmon *O. nerka* occur in the upper Salmon River drainage.

Resident fish include native bull trout *Salvelinus confluentus*, cutthroat trout *O. clarki*, mountain whitefish *Prosopium williamsoni*, redside shiner *Richardsonius balteatus*, sculpins *Cottus spp.*, dace *Rhinichthys spp.*, suckers *Catostomus spp.*, northern pikeminnow *Ptychocheilus oregonensis*, native and introduced rainbow trout *O. mykiss*, and brook trout *S. fontinalis*.

Detailed descriptions of the study areas are available in the Clearwater River subbasin plan (NPT and IDFG 1990), the Salmon River subbasin plan (IDFG et al. 1990), and the IDFG Anadromous Fish Management Plan (IDFG 1992).

Table 1. Idaho Supplementation Studies treatment and control streams. Indented streams are tributaries of the stream immediately above. Responsible cooperators include Idaho Department of Fish and Game (IDFG), Nez Perce Tribe (NPT), Shoshone-Bannock Tribes (SBT), and United States Fish and Wildlife Service (USFWS).

Stream	Treatment (T) or Control (C)	Responsible Cooperator
Clearwater River Basin		
Lolo Creek (including Yoosa Cr.)	T (presmolt)	NPT
Eldorado Creek	C	NPT
Newsome Creek	T (presmolt)	NPT
Crooked River	T (presmolt)	IDFG
American River	T (smolt)	IDFG
Red River	T (presmolt)	IDFG
Clear Creek	T (smolt)	USFWS
White Cap Creek	C	IDFG
Pete King Creek	T (parr)	USFWS
Squaw Creek	T (parr)	NPT
Papoose Creek	T (smolt)	NPT
Colt Killed (White Sand) Creek	T (parr)	IDFG
Big Flat Creek	T (parr)	IDFG
Crooked Fork Creek	C	IDFG
Brushy Fork Creek	C	IDFG
Salmon River Basin		
Slate Creek	T (presmolt)	NPT
South Fork Salmon River	T (smolt)	IDFG, SBT
Secesh River	C	NPT
Lake Creek	C	NPT
Johnson Creek	C	IDFG, NPT
Marsh Creek	C	IDFG
Bear Valley Creek	C	SBT
North Fork Salmon River	C	IDFG
Lemhi River	T (parr and smolt)	IDFG
Pahsimeroi River	T (smolt)	IDFG
East Fork Salmon River	T (smolt)	SBT
Herd Creek	C	SBT
West Fork Yankee Fork Salmon River	T (smolt)	SBT
Valley Creek	C	SBT
Upper Salmon River	T (smolt)	IDFG
Alturas Lake Creek	T (smolt)	IDFG

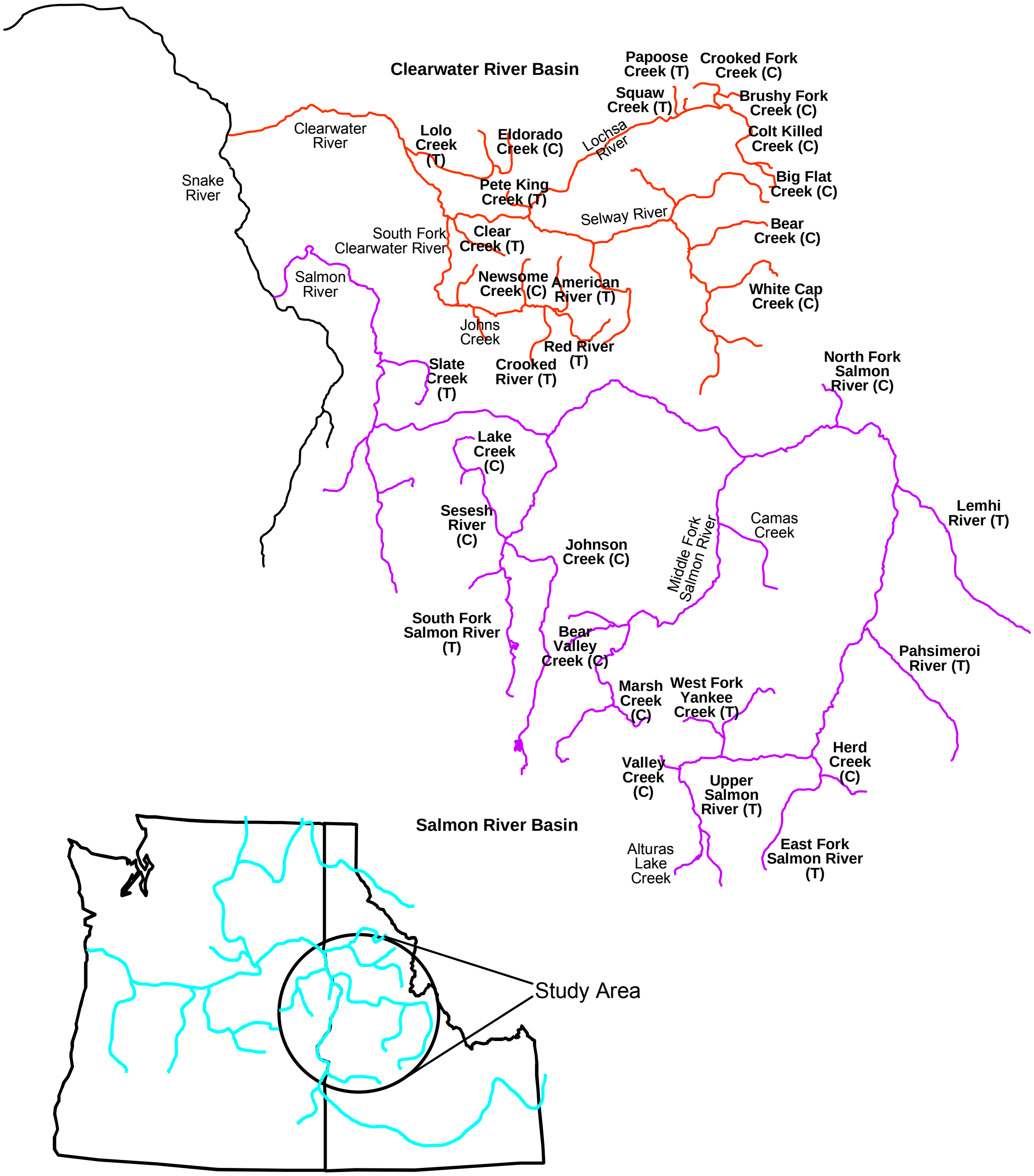

Figure 2. Treatment (T) and Control (C) streams for Idaho Supplementation Studies. Johns Creek, Bear Creek, and Camas Creek were originally control streams, but have been replaced by Eldorado and White Cap creeks and the Secesh River.

METHODS

Ideally, methods would not differ among cooperators for consistency and feasibility of future data comparisons. However, the original study design was brief on some methodologies that needed further refinement in the field. Some inconsistencies in data collection occurred as different methodologies were developed and as researchers became more familiar with the study streams. Such inconsistencies will be noted in the results and discussion where relevant. Detailed information regarding individual cooperators' methods can also be referenced in annual reports published by the various cooperators (Appendix A).

Treatments

Beginning with brood year 1991, juvenile chinook salmon were stocked in treatment streams to assess which life history stage (parr, presmolt, smolt) might be most successful at increasing production. For this study, we define a parr as a juvenile that is not actively emigrating. A presmolt is defined as a juvenile that is emigrating between July 1 and December 31, whereas a smolt emigrates between January 1 and June 30. Supplementation fish were reared in existing IDFG and USFWS hatcheries and satellite facilities following standard hatchery practices. Releases were assigned to treatment streams as proposed in Table 4 and Appendix D of Bowles and Leitzinger (1991), but within the constraints of limited hatchery production due to low adult escapement. Juveniles released in July and August were considered parr; September and October releases were considered presmolts; and smolt releases occurred in March and April. Treatment fish were externally marked (e.g., pelvic fin clip, adipose fin clip) to enable identification of returning adults and ensure differentiation from natural- and hatchery-origin adults for broodstock management. Subsamples of each treatment group were Passive Integrated Transponder (PIT) tagged, weighed, and measured before release. On-site releases occurred at Pahsimeroi and Sawtooth (upper Salmon River) fish hatcheries. Juvenile chinook salmon were released from acclimation ponds at Crooked River and Red River. Colt Killed (White Sand) and Big Flat Creek releases were either from a helicopter or truck, depending on access conditions due to snow. Juveniles were trucked to the remaining off-site release areas.

Summer Parr Population Estimates

To estimate chinook salmon summer (July and August) parr abundance, streams were first divided into sampling strata based on channel and habitat types and areas that chinook salmon traditionally used for spawning and rearing. Channel types included confined, steep gradient reaches (Type B), and lower gradient, meandering reaches (Type C) (Rosgen 1985, 1994). Habitat was stratified into four types: pool, riffle, run, and pocket water. Pool, riffle, and run (glide) correspond to the definitions of Bisson et al. (1982). Pocket water is predominantly swift with numerous protruding boulders or other large obstructions, which create scour holes (pockets) or eddies (McKain et al. 1990). Multiple sample sites were established systematically in each stratum. Each sample site included one or more habitat types confined at both the upper and lower borders by a hydraulic control (Platts et al. 1983, McKain et al. 1990).

Most study streams were surveyed from early July to late August, usually by snorkeling. To ensure adequate incidental light, observations were limited to non-overcast days and between 1000 and 1800 hrs. Counts were also limited to periods when water temperatures were above 10°C unless the stream was normally a colder water stream (Thurow 1994). Prior to snorkeling, visibilities were measured to determine the most efficient fish viewing distance between snorkelers. Enough snorkelers were then used to observe the entire stream width. All salmonids were identified and counted and their lengths estimated. Only the presence or absence of non-salmonids was noted. The length of each site snorkeled was measured and at least three width transects were measured. Techniques and rationale for underwater observation to determine chinook salmon parr abundance are described in Petrosky and Holubetz (1985), Hankin (1986), and Hankin and Reeves (1988).

Multi-pass electrofishing was used in streams that had physical (e.g., high turbidity) or biological (e.g., dense aquatic vegetation) impairments to visual observations. Methods for multi-pass electrofishing and subsequent data analysis followed DeLury (1947), Zippin (1958), Lagler (1978), and Armour et al. (1983).

A parr population estimate and 90% confidence interval were calculated for each stratum following Nemeth et al. (1996). Strata data were summed to obtain a parr population estimate for the area of stream presumed to be inhabited by chinook salmon parr (Table 2). A coefficient of variation of about 15% was the original goal as a precision measurement of snorkel population estimates (Bowles and Leitzinger 1991). Because we used population estimates instead of population means, we used a relative confidence interval to compare the relative precision of our parr population estimates. The relative confidence interval was calculated by dividing the confidence interval by the population estimate. The percent of stream snorkeled was determined by dividing the sum of the length of all sites snorkeled by the stream length of all probable chinook salmon parr habitat. A density (number per $100m^2$) of observed parr only was also calculated. The total number of parr observed in each stream was divided by the total area snorkeled, then multiplied by 100.

Summer Parr Tagging

To determine minimum survival of chinook salmon summer parr to Lower Granite Dam, parr were also PIT tagged in streams with relatively high densities. Often, snorkelers aided in locating the parr. Parr were collected by seining, electrofishing, and with minnow traps when water temperatures were less than 20^oC. PIT tagging protocols followed procedures described by Kiefer and Forster (1991) and the PIT Tag Steering Committee (1992). A minimum goal of 500-700 parr was targeted for tagging, but collected parr were often too small (<60 mm) to tag. Following tagging, parr were held up to 24 hours to observe for lost tags and delayed mortality. When released, they were dispersed throughout the capture area.

Table 2. Downstream and upstream boundaries included in parr population estimates from snorkeling in Idaho Supplementation Studies streams, 1991-1996.

Stream	Downstream Boundary	Upstream Boundary	Strata Length (km)
Clearwater R. Basin			
Lolo Cr.	Campground upstream of N. Fk. Mud Cr.	mouth of Yoosa Creek	20.6
Yoosa Cr.	Mouth	Camp Creek	4.4
Eldorado Cr.	Mouth	Dollar Creek Bridge	7.9
Newsome Cr.	Mouth	1.9 km above the town of Newsome	14.8
Crooked R.	Adult weir	headwaters including E. and W. Fks. Crooked R.	30.2
American R.	Mouth	headwaters (above corrals)	34.6
Red R.[a]	Mouth	headwaters near Shissler Creek	43.0
Clear Cr.[b]	Just above weir at Kooskia National Fish Hatchery	0.2 km above confluence with S. Fk. Clear Creek	20.0
White Cap Cr.[c]	Mouth	migratory barrier	19.8
Pete King Cr.	75 m above mouth	end of Forest Service Road No. 453	8.0
Squaw Cr.	Mouth	confluence of E. Fk. and W. Fk. Squaw Cr.	6.0
Papoose Cr.	Mouth	confluence of E. Fk. and W. Fk. Papoose Cr.	3.0
Colt Killed Cr.	Mouth	“House Rock”-5 km above confluence with Big Flat Cr.	31.1
Big Flat Cr.	Mouth	5 km above mouth	5.0
Crooked Fork Cr.	Mouth	1 km upstream of Hopeful Cr.	29.5
Brushy Fork Cr.	Mouth	migratory barrier above Spruce Cr.	21.5
Salmon R. Basin			
Slate Cr.	Mile marker 3	foot bridge 0.7 km up Little Slate Creek	5.5
S. Fk. Salmon R.	Weir	Headwaters	29.2
Secesh River	Chinook Campground	Mouth of Lake Creek	15.1
Lake Cr.	Mouth	Bridge at Forest Route 318	15.2
Johnson Cr.	Mouth	headwaters (6.6 km above Boulder Creek)	60.1
Marsh Cr.[d]	Mouth	Dry Creek	23.2
Bear Valley Cr.	Fir Creek confluence	Headwaters	35.7
N. Fk. Salmon R.	Mouth	Headwaters	36.8
Lemhi R.[e]	Weir	Leadore	59.7
Pahsimeroi R.	Mouth	Hooper Ln	21.5
E. Fk. Salmon R.	Adult weir	Confluence of S. and W. Fks. of E. Fk. Salmon R.	27.0
Herd Cr.[f]	Mouth	Confluence of W. and E. Fks. of Herd Creek	17.1
W. Fk. Yankee Fk.	Mouth	4 km upstream of Cabin Creek confluence	15.6
Valley Cr.[g]	Mouth	confluence with E. Fk. Valley Creek	52.3
Upper Salmon R.[h]	Sawtooth Hatchery Weir	Highway 75 Bridge	59.0

Table 2. Continued.

[a] In 1991, the sample area included Dawson Creek to L. Moose Creek (4.1 km), and the mouth of the South Fork Red River to the Red River Campground (8.0 km). In 1992, the sample area included Gold Point to the headwaters (27.8 km).
[b] Includes one site snorkeled on the South Fork Clear Creek about 100 m above the confluence with Clear Creek.
[c] Not snorkeled in 1991. Only 12.9 km were included in 1995 and 1996 sampling.
[d] Includes Knapp Creek from the mouth upstream to the headwaters.
[e] Includes Big Springs Creek from the mouth upstream 8.05 km.
[f] Includes 3 km of East Pass Creek from the mouth of Taylor Creek.
[g] Includes Trap Creek from the mouth upstream to the confluence with Meadow Creek, Elk Creek from the mouth upstream to the upper end of Elk Meadow, and Stanley Lake Creek from the mouth upstream to the fish barrier on Stanley Lake.
[h] Includes Alturas Lake Creek (mouth to Alpine Creek) and Pole Creek.

Juvenile Emigration

Rotary-screw traps, floating scoop traps (equipped with a 1 m wide inclined traveling screen), and weirs were operated on 11 streams to collect emigrating juvenile chinook salmon (Table 3). Fish were marked with PIT tags to estimate the number of spring and fall emigrants and to determine minimum survival rates to Lower Granite Dam. Trapping data also provided additional life history information, such as fish size during emigration and emigration timing. Traps were deployed as early in the spring as possible, depending on ice conditions, and were fished continuously through May or June. Traps were redeployed in July, August, or September, and fished until ice up in the fall. When problems were anticipated (e.g., high water, ice), the trap was checked several times during the day and night as necessary. However, mechanical failures, high flows, debris, and ice prevented trap operation on some days. Traps were positioned in the thalweg of each stream when possible, but were sometimes moved out of the thalweg during high water.

Each day, captured juvenile chinook salmon were anesthetized in buffered MS222, scanned for PIT tags, weighed, and measured (fork length to nearest mm). A sample (usually up to 25-50 fish per day) was then marked either with PIT tags or caudal fin clips. The PIT tagging protocols followed procedures described by Kiefer and Forster (1991) and the PIT Tag Steering Committee (1992). From 1992-1994, fish ≥55 mm were tagged. Beginning in 1995, only fish ≥60 mm were tagged. No more than 20 juveniles were anesthetized at one time. Tag needles and PIT tags were sterilized in a 70% ethanol solution. After tagging, juveniles were held in the stream in flow through boxes. Fish were usually released at dusk, but sometimes were released 15-30 minutes after tagging. Newly marked juveniles were released approximately 0.5-1.6 km upstream of the trap, or at least to the head of the first riffle above the trap. Fish showing signs of stress (e.g., descaling, poor equilibrium) were released untagged, downstream of the trap.

A goal of tagging at least 300 fall and 100 spring wild/natural emigrants per stream was targeted (Bowles and Leitzinger 1991). Data (species, length, weight) were also collected on non-target species to assist other projects. Deviations from the above methods are described in previous ISS reports submitted to BPA (Appendix A).

We used software developed by the National Marine Fisheries Service-Auke Bay Laboratory to estimate trap efficiencies and numbers of chinook juveniles emigrating past the traps (M. L. Murphy, Auke Bay Laboratory, personal communication). The software calculates trap efficiency as follows:

$$\hat{E} = \frac{R+1}{M+1}$$

where $\hat{E}$ = trap efficiency, R = number of marked fish recaptured, and M = number of marked fish released above the trap. Trap efficiencies were calculated for two periods, fall (July 1 through December 31), and spring (January 1 through June 30). The software then uses the bootstrap method to estimate the number of emigrants passing the trap (Efron and Tibshirani 1986, 1993; Murphy et al. 1992; Thedinga et al. 1994). We conducted spring (smolt) and fall (presmolt) emigrant estimates and ran 1,000 iterations to obtain each estimate. We then determined 90% confidence intervals for each estimate, based on the percentiles of the bootstrap distribution (Buckland 1984; Efron and Tibshirani 1993; M. L. Murphy, personal communication). We present all of the estimates regardless of the number of recaptures. However, at least three to four recaptures are needed to decrease the chance of statistical bias in the estimate (Ricker 1975).

Precocious male chinook salmon caught in traps were not included in emigrant estimates. Also, chinook salmon fry caught during the spring trapping season were not included, as they were too small to tag for trap efficiency estimates. Spring fry numbers were tallied and are presented separately.

Table 3. Locations of juvenile chinook salmon traps on Idaho Supplementation Studies streams and years of operation, 1991-1996.

Stream	Trap Type	Trap Location	Years Operated
Clearwater River Basin			
Lolo Cr.	Rotary screw (2)	1.0 and 41 km above mouth[a]	1992-1996
Crooked R.	Floating scoop	0.2 km above mouth (below adult weir)	1992-1996
Red R.	Rotary screw	400 m upstream of mouth	1992-1996
Clear Cr.	Juvenile weir	About 0.1 km below Kooskia National Fish Hatchery intake system	1994[b]
	Rotary screw	Just below Kooskia National Fish Hatchery intake system	1993-1996
Crooked Fork Cr.	Rotary screw	3.2 km upstream from mouth	1992-1996
Salmon River Basin			
S. Fk. Salmon R.	Rotary screw	Knox Bridge[c]	1992-1996
Marsh Cr.	Rotary screw	.25 km upstream from confluence with Capehorn Cr.	1993-1996
Lemhi R.	Weir	0.8 km upstream of Hayden Cr.	1991-1993
	Rotary screw	0.2 km upstream of Hayden Cr.	1994-1996
Pahsimeroi R.	Rotary screw	Below weir at Pahsimeroi Hatchery	1992-1996
E. Fk. Salmon R.	Rotary screw	300 m downstream of adult weir	1993-1996
Upper Salmon R.	Floating scoop	Below intake facility at Sawtooth Hatchery	1995-1996[d]
Upper Salmon R.	Floating scoop	Below weir at Sawtooth Hatchery	1992-1996

[a] The trap located 41 km above the mouth was operated in the fall only.
[b] Operated in fall 1994 only.
[c] Trap was located below the adult weir from fall 1992 to fall 1993 and fall 1994 to fall 1995. The trap was located at Knox Bridge (upstream of the adult weir) in spring 1994 and spring 1996. Therefore, any production between the weir and Knox bridge (as documented by redd counts) was not accounted for by the Knox Bridge screw trap.
[d] Operated in the fall, but not spring 1995.

Adult Escapement

Chinook salmon adult escapement is another parameter important to supplementation evaluation. Various parameters were measured to estimate escapement and age composition of adults, including weir returns, redd counts, and carcass recoveries. Most adult chinook salmon returning to supplementation streams from 1991 to 1995 were of indeterminate origin (i.e., unknown whether they were hatchery- or natural-origin fish). Beginning in 1996, all year classes of returning adults could be separated between hatchery (general production and supplementation) and natural origin based on fin clips.

For streams with weirs where at least 20 adult chinook salmon were handled (including any fin-clipped or unmarked fish), we assigned ages to individual fish based on length frequencies from hatchery personnel (IDFG Hatchery Run Reports for 1991-1996). If less than 20 adults were trapped on a stream with a weir, we assigned ages based on length frequencies of carcasses and all adult chinook salmon trapped at other weirs within the basin (i.e., Salmon or Clearwater) that year.

For streams without weirs, we broke out age groups based on chinook salmon carcasses (if ≥20 recovered) from the stream that year. Carcasses were assigned to age groups based on length cutoffs as follows: age-1.1: <640 mm, age-1.2: 640-789 mm, age-1.3: ≥790 mm (Beamesderfer et al. 1997). Age is expressed in European Notation, with the number before the decimal being the number of complete years spent in freshwater and the number after the decimal being the number of years spent in the ocean. If <20 carcasses were recovered, we broke out age groups based on the combined sample of carcasses and weir returns for that basin and year.

To estimate total escapement, we multiplied the redd count by a 3.2 fish per redd constant (Beamesderfer et al. 1997). This estimated total escapement for a particular return year was then separated into brood year returns based on age group composition. Total return for each brood year was then calculated by summing the estimated escapement of each age class.

Adult Returns to Weirs

Weirs were operated on 11 streams from 1991-1996 to capture jack and adult chinook salmon (Table 4). Adult chinook salmon captured at weirs were handled according to standard hatchery practices. Varying proportions of fish trapped were held for broodstock or passed above the weir to spawn naturally. These proportions were based on adult escapement and protocols outlined in Bowles and Leitzinger (1991). Biological characteristics measurable with nonlethal methods (fork length, sex, external tags, or fin clips) were recorded when possible for fish passed above weirs.

Table 4. Locations of adult chinook salmon weirs on Idaho Supplementation Studies streams and years of operation, 1991-1996.

Stream	Weir Location	Years Operated
Clearwater River Basin		
Crooked R.	0.3 km above mouth	1991-1996
Red R.	20.9 km above mouth (at Red River Satellite Facility)	1991-1996
Clear Cr.	Kooskia Nat. Fish Hatchery	1991-1996
Walton Cr.[a]	25 m upstream from mouth	1991-1996
Lochsa R.	Powell Satellite Facility[b]	1991
Crooked Fork Cr.	Highway 12 bridge[c]	1994
Salmon River Basin		
S. Fk. Salmon R.	300 m downstream from mouth of Warm Lake Cr.	1991-1996
Marsh Cr.	.25 km upstream from confluence with Capehorn Cr.	1993-1994
Lemhi R.[d]	0.8 km above Hayden Cr.	1992-1994
Pahsimeroi R.	Pahsimeroi Hatchery	1991-1996
E. Fk. Salmon R.	100 m upstream from confluence with Big Boulder Cr.	1991-1996
Upper Salmon R.	Sawtooth Hatchery	1991-1996

[a] Tributary of the Lochsa River at Powell; adults returning here are used for general hatchery production, but also as broodstock for juvenile treatments on Colt Killed Creek.
[b] Just below the confluence of Crooked Fork and Colt Killed Creeks.
[c] Just upstream from the confluence with Brushy Fork Creek.
[d] Weir operated only until June 17 in 1994; not installed until August 5 in 1992.

Redd Counts and Carcass Recoveries

Spawning escapement was documented by conducting redd counts from August to October following protocols described in Hassemer (1993a). Carcasses were also recovered during these surveys. Historically in Idaho, spawning escapement has been estimated with a single annual count of redds in index (trend) areas where the majority of production occurs (Hassemer 1993b). However, the intention of the ISS study design is to measure total production, so our redd counts included all probable chinook salmon spawning habitat in each stream (Table 5). Total stream length surveyed sometimes varied depending on flow conditions and adult escapement. During the first few years of the study, survey areas also varied as researchers became more familiar with study stream drainages. Surveys included aerial and ground counts. Aerial counts were one day, peak spawning time counts using a helicopter. In some streams, there was overlap between areas surveyed for supplementation counts and IDFG trend areas (Hassemer 1993b). Supplementation counts were precedent to trend counts, and ground counts were precedent to aerial counts for ISS data reporting. Typically, ground counts were conducted a minimum of three times during the spawning period. Multiple ground counts allowed survey crews to be on the stream either during redd construction or shortly thereafter, thus aiding in redd identification. In addition, multiple counts increased the number of adult chinook salmon carcasses recovered. All redds were marked on site and noted on topographic maps.

Data collected from carcasses included length (fork length and mid-eye to hypural [MEHP] length), sex, percent spawned, and the presence of external tags or fin clips. Scales were collected from all carcasses for aging analysis. Snouts were collected from carcasses potentially possessing coded-wire tags (CWTs) (i.e., those with adipose fin clips or other marks indicating general production hatchery fish) to determine age and stocking origin. To mark the carcass before returning it to the stream, the caudal peduncle was deeply severed. Scales were aged by the IDFG and Columbia River Intertribal Fish Commission, though this method is undergoing more study and refinement. The CWTs were read by IDFG and USFWS personnel and will be used in future analyses to determine straying.

Table 5. Stream sections surveyed for chinook salmon redds and carcasses, 1991-1996. Some survey years included a reduction or increase in effort depending on flow conditions and run strength.

Stream	Downstream Boundary	Upstream Boundary	km
Clearwater R. Basin			
Lolo Cr.	Bradford Bridge	Yoosa Creek	16.7
Yoosa Cr.	Mouth	Camp Creek	4.4
Eldorado Cr.	Snow Creek	Fan Creek	3.5
Newsome Cr.	Mouth	Mule Creek (2.2 km above town of Newsome)	15.1
Crooked R.	Mouth	West Fork Crooked River confluence	20.9
American R.[a]	Mouth	long meadow above Limber Luke Cr.	34.6
Red R.[b]	Mouth	headwaters near Shissler Creek	43.0
Clear Cr.	Mouth	end of road, 16.1 km upstream of mouth	16.1
White Cap Cr.[c]	Mouth	migration barrier	19.8
Pete King Cr.	Mouth	end of Forest Service Road No. 453	8.0
Squaw Cr.	Mouth	confluence of E. Fk. and W. Fk. Squaw Cr.	6.0
Papoose Cr.	Mouth	confluence of E. Fk. and W. Fk. Papoose Cr.	3.0
Colt Killed Cr.	Big Flat Cr.	Garnet Creek	11.5
Big Flat Cr.	Mouth	8.3 km upstream from mouth	8.0
Crooked Fork Cr.[d]	Mouth	just above Hopeful Creek	29.5
Brushy Fork Cr.[e]	Mouth	migration barrier above Spruce Creek	21.5
Salmon R. Basin			
Slate Cr.	Willow Creek	foot bridge 0.7 km up Little Slate Creek	5.5
S. Fk. Salmon R.[f]	Weir	1 km upstream of Vulcan Hot Springs trail	29.2
Secesh River[g]	Alex Creek	Grouse Mountain Bridge	10.3
Lake Cr.	Mouth	Willow Creek	13.6
Johnson Cr.[h]	Deadhorse Rapids	Swamp Creek	31.0
Marsh Cr.[i]	Capehorn Creek	Dry Creek	11.0
Bear Valley Cr.	Fir Creek	Casner Creek	35.7
N. Fk. Salmon R.	Mouth	upper end of Elk Meadows Ranch	36.8
Lemhi R.	Hayden Creek	Leadore	51.7
Pahsimeroi R.[j]	Mouth	5 km upstream of Hooper Lane	26.5
E. Fk. Salmon R.[k]	adult weir	confluence of S. and W. Fks. of E. Fk. Sal. R.	27.0
Herd Cr.[l]	Mouth	confluence of W. and E. Fks. of Herd Cr. 1	17.1

Table 5. Continued.

Stream	Downstream Boundary	Upstream Boundary	km
W. Fk. Yankee Fk. Salmon R.	Mouth	Cabin Creek	11.6
Valley Cr.[m]	Mouth	Confluence with E. Fork Valley Creek	52.3
Upper Salmon R.[n]	Weir	Highway 75 bridge	59.0

[a] Aerial count done in 1991.
[b] Includes South Fork Red River from the mouth to Trapper Creek. Only 23.6 km of stream sampled in 1991.
[c] Not counted in 1991.
[d] Includes Hopeful Creek.
[e] Includes Spruce Creek.
[f] Includes Curtis Creek from the mouth to approximately 1.67 km upstream.
[g] Alex Creek is below the screw trap, but no redds were found between Alex Creek and the screw trap.
[h] Does not include the mouth to Deadhorse Rapids, or the canyon section beginning near Burnt Log Creek, as there is no spawning habitat in these areas. Beginning in 1994, 4 km of Burnt Log Creek was also surveyed from the mouth to 2.0 km above Buck Creek.
[i] Includes 8.7 km on Marsh Creek and 2.3 km of Knapp Creek from the mouth to the end of Asher Creek Road.
[j] Includes Patterson Creek from the mouth to Hooper Lane.
[k] Spawning adults below the weir are considered a summer run population. This production is not included in our study.
[l] Includes 3 km of East Pass Creek from the mouth to Taylor Creek.
[m] Includes Trap Creek from the mouth to the confluence with Meadow Creek, Elk Creek from the mouth to the upper end of Elk Meadow, and Stanley Creek from the mouth to the fish barrier on Stanley Lake.
[n] Includes Alturas Lake Creek from the mouth to Alturas Lake, and Pole Creek.

PIT Tag Detections

Two evaluation points for determining supplementation effects are number of smolts arriving at, and juvenile survival rates to, Lower Granite Dam. To estimate these parameters, treatment fish were PIT tagged before release (see treatment methods above). Natural (progeny of parents which spawned voluntarily in the natural environment) and wild (natural fish whose ancestry has had little or no potential impact from artificial propagation or translocation) fish were sampled with juvenile traps, PIT tagged, and released (see juvenile emigration methods below). Portions of these tagged fish groups were then interrogated at PIT tag detection facilities (interrogation sites) located in Snake and Columbia River dams. These facilities differ in design and function and operate at different efficiencies. Detection efficiency also varies depending on the use and timing of spill. The PIT tag detection data are stored and disseminated from the Columbia River Basin PIT Tag Information System (PTAGIS) database (PSMFC 1998).

We queried the PTAGIS database for each study stream by migratory year for information on detection numbers at Lower Granite (LGR), Little Goose (LGS), Lower Monumental (LMN), and McNary (MCN) Dams. Data were sorted to determine the first unique detection at each dam site. Unique detections from interrogation sites below LGR were summed with those at LGR to obtain the total number of detected fish that reached LGR.

Minimum estimates of survival to LGR were based on cumulative detections. We considered a PIT tag detection valid if it had at least two coil "reads" (interrogation counts) at any given observation site. We also queried for the travel (passage) time (detection date minus release date) at LGR. Passage timing of 10%, 50%, and 90% of each release group was calculated from frequency distributions of detection dates at LGR.

RESULTS

Treatments

Juvenile chinook salmon were released into treatment streams from July 1992 to April 1997 (brood years 1991-1995; Appendix B). Out of 100 treatments proposed in the study design, 40 (40%) were completed (Table 6). Of these 40 treatments, 21 occurred in the Clearwater River basin, and 19 occurred in the Salmon River basin. Four treatments were inconsistent with the life stage outlined in the original study design (Bowles and Leitzinger 1991). Smolts were stocked in Newsome Creek in 1995, though this stream was proposed to receive presmolt releases. Also, the West Fork Yankee Fork Salmon River and upper Salmon River received presmolt (rather than smolt) releases on three occasions. Overall, 25% of the proposed number (13,165,000) of treatment fish was actually outplanted.

Table 6. Number of treatments proposed and accomplished in the Clearwater and Salmon River basins for brood years 1991-1995.

Basin	Life Stage	Number of Proposed Treatments	Number of Accomplished Treatments	Percent Released of Proposed Number of Fish to Release
Clearwater River	parr	20	10	59
	presmolt	25[a]	5	8
	smolt	15	6	51
Salmon River	parr	5	0	0
	presmolt	5	3	27
	smolt	30	16	28
Totals		100	40	25

[a] Includes the five proposed treatments for Crooked Fork Creek.

In the Clearwater River basin, supplementation releases of parr, presmolts, and smolts totaled 1,321,445 fish (Table 7). Presmolt and smolt releases in the Salmon River basin totaled 1,932,049 fish. Average release dates for smolts in the Clearwater and Salmon River basins were April 7 and April 10, respectively. Release dates occurred as early as March 12 and as late as April 22.

Table 7. The number, fork length, and average release dates for juvenile chinook salmon stocked into Idaho Supplementation Studies treatment streams.

Basin	Life Stage	Number Released	Average Fork Length	Fork Length Standard Deviation	Average Release Day	Earliest Release Day	Latest Release Day
Clearwater	Parr	424,933	85	16	July 22	July 5	Aug 6
River	Presmolt	315,048	113	10	Sept 26	Sept 5	Oct 12
	Smolt	581,464	130	18	April 7	Mar 12	April 15
Salmon	Parr	0	—	—	—	—	—
River	Presmolt	322,355	97	7	Oct 24	Oct 19	Oct 29
	Smolt	1,609,694	126	9	April 10	Mar 19	April 22
Totals		3,253,494					

In 1993, a relatively good return year, adult returns at some hatchery facilities exceeded production capabilities. The adaptive management response was to outplant excess adults into other streams (Table 8).

Table 8. Adult outplants into Idaho Supplementation Studies streams.

Stream	Outplant Date	No. of Males	No. of Females	Total No. Outplanted	Broodstock [a]
Newsome Cr.	8/9/93	125	125	250	RPR
American R.	8/93	165	165	330	RPR
Colt Killed Cr.	8/2/93	25	15	40	POW

[a] RPR = Rapid River, POW = Powell.

Parr Population Estimates and Densities

Chinook salmon parr population estimates ranged from 0 to 206,470, while densities ranged from 0 to 93 fish/100m^2 (Appendix C.) Relative confidence intervals ranged from 7.5% to 264.5%, and often exceeded 100%. Only 2.3% (3/130) of the relative confidence intervals were ≤15%.

Juvenile Emigration

Estimated numbers of emigrating presmolt and smolt chinook salmon are presented in Appendix D. Highest production occurred in brood year (BY) 1993 for most streams, though data are incomplete for some streams during some years. For emigrant estimates with at least three recaptures, the highest number of emigrants was 77,977 BY93 presmolts on Crooked Fork Creek in fall 1994. The lowest estimated number of emigrants was 79 BY92 smolts in the East Fork Salmon River in Spring 1994, and only three smolts were caught in Marsh Creek in spring 1996 (BY94). Most fish emigrated as presmolts, but this pattern was not consistent among years. For all streams combined, trap efficiencies ranged from 0% to 67% for fall presmolts and from 2.8% to 59.6% for spring smolts. In the Salmon River drainage, median trap efficiencies were 12% and 13.5% for presmolts and smolts, respectively. In the Clearwater River drainage, median trap efficiencies were 19.8% and 18.2% for presmolts and smolts, respectively.

Numbers of chinook salmon fry trapped in spring are shown in Table 9. Numbers ranged from zero (many streams and years) to 15,559 on the South Fork Salmon River in 1994 (BY93).

Table 9. Number of chinook salmon fry caught during spring trapping on Idaho Supplementation Studies streams in the Clearwater and Salmon River drainages, brood years 1991-1995. A " — " indicates no data.

Drainage Stream Brood Year	Trap Start Date	Trap End Date	Number of Days Trapped[a]	Number of Fry Trapped	Number of Mortalities
Clearwater Drainage					
Lolo Creek					
1995	1/3/96	6/27/96	78	1	0
1994	1/18/95	6/30/95	111	33	0
1993	1/19/94	6/23/94	81	—	—
1992	3/9/93	6/17/93	66	—	—
Crooked River					
1995	3/14/96	6/11/96	89	0	0
1994	3/15/95	6/6/95	82	0	0
1993	3/18/94	6/15/94	89	231	0
1992	3/13/93	6/9/93	88	94[b]	0
Red River					
1995	3/12/96	6/30/96	101	0	0
1994	3/14/95	5/31/95	76	0	0
1993	3/29/94	5/25/94	57	22	0
1992	3/18/93	6/8/93	81	36	1
Clear Creek					
1995	3/1/96	6/30/96	122	18	0
1994	3/14/95	6/29/95	60	64	1
1993	3/14/94	6/26/94	105	36	1
1992	5/13/93	6/30/93	49	23	0
Crooked Fork Creek					
1995	3/22/96	6/30/96	79	11	0
1994	3/19/95	6/8/95	76	1	0
1993	3/16/94	6/1/94	73	540	22
1992	3/17/93	6/8/93	79	56	2

Table 9. Continued.

Drainage Stream Brood Year	**Trap Start Date**	**Trap End Date**	**Number of Days Trapped**[a]	**Number of Fry Trapped**	**Number of Mortalities**
Salmon River Drainage					
South Fork Salmon River					
1995	3/20/96	5/15/96	53	5	—
1994	4/3/95	6/2/95	55	32	—
1993	3/16/94	6/1/94	77	15,559	173
1992	4/3/93	6/14/93	70	2,474	0
Marsh Creek					
1995	3/16/96	5/29/96	66	0	0
1994	3/30/95	6/8/95	67	0	0
1993	3/16/94	6/1/94	63	1,165	12
1992	4/8/93	6/1/93	49	773	8
Lemhi River					
1995	3/12/96	6/30/96	91	24	0
1994	3/17/95	6/1/95	74	8	0
1993	3/11/94	6/30/94	111	727	0
1992	2/28/93	5/31/93	92	23	—
Pahsimeroi River[c]					
1995	3/12/96	6/30/96	106	45	0
1994	3/15/95	6/21/95	85	39	0
1993	3/3/94	6/1/94	90	429	14
1992	4/3/93	6/2/93	58	0	0
East Fork Salmon River					
1995	3/4/96	5/30/96	84	0	0
1994	3/7/95	5/31/95	81	164	0
1993	3/14/94	5/27/94	73	240	0
1992	4/7/93	5/21/93	42	25	0
Upper Salmon River					
1995	3/8/96	5/16/96	63	1[b]	0
1994	3/10/95	6/6/95	88	11	0
1993	3/9/94	6/9/94	91	570	4
1992	4/3/93	6/9/93	67	18	0

[a] Traps did not operate on some days, usually due to high water, obstruction with debris, or ice.
[b] May include other salmonid fry, as positive identification was not made on some fish.
[c] May be an underestimate as some young of year may have been tagged and included in the spring emigration estimate.

Adult Escapement

Escapement Estimates

Adult escapement estimates are presented in Appendix E. The majority of Clearwater River basin streams contained at least one adult return year that consisted of zero fish. Return years that consisted of zero fish were not as prevalent on Salmon River tributaries. Estimated adult returns for any particular year for Clearwater River and Salmon River basin streams ranged from 0-669 and 0-2221, respectively. Variation between and among years of adult returns was considerable for both Clearwater River basin and Salmon River basin streams.

For this report period, the only brood years with complete components (Ages 1.1, 1.2, 1.3) of adult returns were 1990 and 1991. The majority of adult returns were age-1.2 for the Clearwater River and Salmon River basins. Expanded adult return numbers by brood year for Clearwater River and Salmon River basins for 1990-1991 ranged from 0-81 and 0-122, respectively.

Adult Returns to Weirs

Adult chinook salmon returns to weirs are presented in Appendix F, Tables 1-3. Supplementation-marked fish, mainly jacks (age-1.1), began returning to weirs in 1995. By 1996, most weirs trapped supplementation-marked age-1.2 fish. Also in 1996, a few age-1.3 supplementation-marked fish returned to the Walton Creek, South Fork Salmon River, Pahsimeroi, and Sawtooth weirs. Supplementation-marked fish returning to the Walton Creek weir in any year were strays, possibly from fish stocked in Colt Killed and Papoose creeks.

Redd Counts and Carcass Recoveries

Redd counts are summarized in Appendix G. Counts ranged from zero (numerous streams and years) to 694 (23.77 redds/km) on the South Fork Salmon River in 1993. Redd counts were highest on most streams in 1993. Carcass recovery data are given in Appendix H.

PIT Tag Detections

Detections of PIT-tagged juvenile chinook salmon are summarized in Appendix I. In the Salmon River drainage, smolt detection rates for wild and natural smolts were three times higher than for hatchery smolts (Appendix J). The detection rate of hatchery presmolts released in the Salmon River drainage was six times lower than for presmolts released in the Clearwater River drainage. For natural and wild fish, the detection rate of fish PIT-tagged as presmolts was about two times greater than that for fish PIT-tagged as parr. The hatchery and natural smolt detection rates were about equal in the Clearwater River drainage, and both were greater than twice the presmolt detection rate. The Salmon River drainage smolt detection rate was less than that in the Clearwater River drainage (Appendix J).

Few consistent patterns in travel time to Lower Granite Dam are apparent (Appendix J). The migration period for hatchery smolts was shorter as compared to natural smolts. For example, hatchery smolts attained 90% passage to Lower Granite Dam two weeks after the first 10% arrived (based on median passage dates). In comparison, natural smolts attained 90% passage six weeks after the first 10% arrived. However, natural and wild smolts are tagged and released throughout the spring, while hatchery fish for a given stream are released at one time. Passage dates also varied among tagged cohorts among years. For example, the earliest date of 90% passage for a cohort was April 25, while the latest date of 90% passage was August 10 (Appendix J).

DISCUSSION

Treatments

Low hatchery production, due to insufficient adult escapement, required adaptive management when addressing proposed stocking treatments. Low production resulted in less than one-half the treatments proposed in the study design being applied. One adaptive management decision was to release smolts (rather than presmolts) in Newsome Creek in spring 1995 (brood year 1993). Managers hoped this smolt release would increase adult returns relative to a presmolt release, based on the higher detection rates seen for smolts earlier in the study. On the upper Salmon River, many natural juveniles emigrated past the juvenile traps in the fall. Additionally, at the Sawtooth Hatchery, behavior of some of the fish (e.g., congregating toward the tail end of raceways in late summer and fall) led researchers to conclude that some hatchery fish were ready to emigrate in fall as well. Thus, two presmolt releases, in addition to smolt releases, occurred on the upper Salmon River. The 1993 adult outplants were not originally planned, but this adaptive management decision may allow evaluation of this additional supplementation life stage.

The core of the ISS study depends on treatment evaluations. With insufficient broodstock to produce treatment fish, supplementation evaluation may be difficult to achieve for some streams.

Parr Population Estimates and Densities

Snorkel surveys showed variation in chinook salmon parr numbers among streams and years (Appendix C). Parr population estimates and densities were greatest in 1994, reflecting the high (relative to the other four years of the study) redd counts in 1993. Relative confidence intervals were large and beyond the precision called for in the study design (Bowles and Leitzinger 1991). This imprecision was possibly due to the small proportion (usually <10%) of each stream snorkeled, along with the often low and clustered densities of parr (e.g., Appendix C1 of Kiefer and Lockhart 1997). However, changes in population estimation methods (strata based on habitat types versus channel type) and increases in sampling effort (increased number of sites) did not reduce variability or increase precision (Leitzinger et al. 1996; Nemeth et al. 1996). In other examples, intensive sampling over numerous years at Crooked River generally did not produce confidence intervals less than 30 percent (R. Kiefer, IDFG, personal communication). Extensive snorkeling in Brushy Fork Creek failed to reduce variation during 1996 (Appendix C).

Snorkel surveys were inaccurate and probably underestimated true parr production. The number of redds counted had no relationship to parr population estimates. The numbers of parr produced per redd ranged from 1,547 parr for zero redds observed to 7,142 parr for one redd observed. Although inaccurate redd counts may make parr estimates appear erroneous, downstream movement of chinook salmon parr prior to snorkel surveys may also contribute to conservative estimates. For example, chinook salmon fry in the upper Salmon River are known to migrate downstream throughout the spring, before summer snorkel surveys occur (Peery and Bjornn 1996). Our study has documented similar patterns (Table 9).

Parr population estimates also appeared inaccurate when compared to estimates of fall emigrants passing the juvenile traps. The number of juveniles trapped and the number of migrants were sometimes as high as, or exceeded, the corresponding parr population estimates (Leitzinger et al. 1996).

Due to a lack of accuracy and precision, we recommend ending snorkel surveys. Time and resources saved will allow for additional efforts at tagging summer parr to provide population and survival estimates based on downstream detections.

Juvenile Emigration

Juvenile trapping provided data for emigrant population estimates as called for in the ISS experimental design (Bowles and Leitzinger 1991). However, these estimates should be considered more as production indices rather than absolute population numbers for the following reasons. First, the estimates do not account for fry caught in the spring that were too small to mark for trap efficiency estimates. Chinook salmon fry are known to migrate downstream of spawning areas during spring beginning shortly after emergence at lengths of 33 mm (Peery and Bjornn 1996; our own data from this study). Therefore, we assume our emigrant estimates are conservative, as they do not account for these small fish. There were also periods when our traps were not, or could not, be fished. For example, traps were not fished during the summer the first few years of the study. However, when we started fishing traps in the summer, some caught fish. Some fish probably migrate past trap sites in winter as well, when ice and snow prevent trap operation. Finally, high water events occasionally prevented trap operation. Pulses in juvenile salmonid emigration are believed to occur during high water events. This could also result in a conservative emigrant estimate.

We recommend continuing juvenile trapping and PIT tagging. It is the most efficient tool we have to estimate (index) juvenile production. This parameter will be important for future comparisons between treatment and control streams. Trapping results will also show temporal trends in juvenile production. For example, the 1992-1996 data indicate only one relatively strong year class. Additionally, juvenile trapping provides an efficient means of collecting fish for tagging (on which survival estimates are based) and of monitoring migration timing.

Adult Escapement

Low adult escapement numbers to ISS streams support the concern over declining chinook salmon stocks in Idaho. We realize that the estimated escapements are based on expanded redd counts (i.e., using 3.2 fish/redd to estimate adult escapement), and brood year returns partitioned based on limited age data. However, we do not feel our results are so conservative that they misrepresent declining chinook salmon populations.

While compiling data related to adult escapement, several needs were identified. First, more data is needed on the number of adult chinook salmon per redd to determine if 3.2 fish/redd is accurate for Idaho streams. Aging techniques must also be refined for increased accuracy, as estimates of adult returns by brood year are based on extrapolated age data. Continued CWT analysis will improve accuracy in aging hatchery fish. Other aging techniques must be investigated, or current methods refined, for application to naturally-produced or wild fish. Methodologies for determining parameters related to smolt-to-adult return ratios also need refinement. For example, population estimates of smolts must be calculated based on numbers of parr, presmolts, and smolts trapped as well as their survival rates. This research is ongoing among cooperators.

Weir Returns

Because the spring run-off period varied from year to year, weirs could not always be installed prior to jack and adult arrivals. Therefore, some fish (including unmarked, supplementation marked, and general hatchery production marked fish) probably migrated above the weir site before weir installation. Although this unknown segment of the run will make analyses more difficult, the problem cannot be avoided. In addition, on some streams (South Fork Salmon River, Red River), spawning occurred downstream of weirs. In these cases, redd counts below the weir will have to be considered along with weir returns to estimate total escapement.

Redd Counts

When redd counts are related to parr estimates, it is evident that redds in some streams were not detected. For example, some streams had parr production (as evidenced by snorkel counts), but had no redds counted in the previous year. Some streams are high gradient with large cobble and boulder substrates. Spawning gravels are isolated in small areas behind large woody debris, large boulders and along the edges of the stream. These conditions are less than ideal for the observer to locate redds. However, parr observed during snorkel surveys in streams that had no redds may have emigrated from other streams.

Because redd numbers are the best measurable indicator of adult escapement, redd counts should be conducted as accurately and comprehensively as possible. Where necessary, we recommend conducting multiple pass survey methods stratified over the entire season of spawning activity, while continuing to sample as much of the suitable spawning habitat in each stream as possible. For comparison purposes, it is important that within stream effort is consistent among years. Thorough and comprehensive redd surveys will also improve carcass survey information as carcass surveys are conducted simultaneously with redd counts. Efforts to collect carcasses among and within years and cooperators were not always consistent from 1991-1996. When analyzing these data, possible bias due to inconsistent effort must be considered.

Likewise, carcass recoveries should be conducted thoroughly and accurately. It will be critical to know the proportion of marked fish on the spawning grounds to measure if natural spawner numbers increase in response to supplementation.

PIT Tag Detections

Detection data indicates a need to review treatment strategies, especially relative to declining adult escapement to Idaho streams. Stocking smolts (as opposed to presmolts) may be a better immediate use of hatcheries for conservation purposes based on higher detection rates for smolt release groups. However, a final decision will depend on several factors, including the trade-off in costs of raising fish to smolt size, fish condition, and relative detection rates of out-migrants. Most important, the decision should be based on which life stage produces the maximum fitness and number of adult returns. Additional years of adult return data are needed to help make this decision.

Juvenile detection rate comparisons indicate that hatchery fish survival (after release into the wild) is generally less than that of wild and natural fish. However, egg to juvenile survival in the hatchery is high relative to naturally produced fish. Natural rearing can increase post-release survival of hatchery chinook smolts, relative to those raised under conventional hatchery methods (Maynard 1996). Thus, it will be beneficial to continue to emulate natural rearing conditions as much as possible when raising hatchery fish, and to evaluate these natural-rearing techniques.

Project Contributions to Management and Other Research

Although the first five years consisted mainly of gathering baseline data, Idaho Supplementation Studies has contributed data applicable to fisheries management and other research in Idaho. Examples pertaining to management activities include:

– South Fork Salmon River chinook salmon
 Idaho's largest summer chinook salmon run and largest hatchery supplementation program occur in the South Fork Salmon River. The South Fork Salmon drainage has one well-established hatchery run in the mainstem; one completely wild run in the Secesh River; and one natural run with a proposed supplementation program in Johnson Creek. Intensive monitoring data are collected throughout the drainage for ISS. Responses to changes in hatchery practices will likely be more measurable here than in any other drainage in the state.

– Resident species distributions
 Snorkeling and trapping activities have provided species distribution, size, and abundance data for resident species (e.g., brook trout, bull trout, westslope cutthroat trout, and amphibians) on many streams that would not otherwise have been collected with the same frequency. These data have also been used to help IDFG evaluate fishing regulations (e.g., for westslope cutthroat trout), and to help determine water quality status of the state's streams (State of Idaho-Division of Environmental Quality).

– Land management practices
 Chinook salmon redd count survey data have been used in watershed analyses and NEPA and biological assessment documents for proposed federal land management activities. Data collected from ISS have allowed IDFG personnel to comment more specifically on land use practices and impacts proposed by various agencies and private entities. This information has also helped IDFG develop instream work windows for dredge mining and other activities. Work on the Lemhi River has contributed to model

watershed projects and helped identify areas for habitat restoration (e.g., stream reconnections).

– Statewide redd count trend analyses

Multiple count surveys have helped to calibrate redd counts obtained from traditional index areas. Some regional surveys have used these data to modify trend surveys to be more representative.

Examples of ISS data used to assist other research projects includes:

– General parr monitoring (parr population densities; IDFG)

Snorkeling data collected during ISS complement the less intensive general parr monitoring, and can be used to enhance that database.

– Smolt and adult passage at the lower Snake and Columbia River dams (IDFG)

– Data from PIT-tagged juvenile chinook salmon and steelhead is used to estimate survival through the eight dams on the lower Snake and Columbia rivers

– Factors affecting juvenile chinook salmon emigration (National Marine Fisheries Service)

Trapping data is providing information on how environmental conditions affect juvenile chinook salmon movement. Identifying drainage specific behaviors may help to develop appropriate supplementation treatments on a population by population basis.

– Bull trout research (Bureau of Land Management, IDFG, United States Forest Service [USFS])

Length, weight, age, genetic and movement information has been collected from bull trout caught in juvenile traps. These data have helped document life history characteristics (e.g., movement between subdrainages, age of spawners) of bull trout, especially in the South Fork Clearwater River drainage.

– Other anadromous species

Pacific lamprey (*Entosphenus tridentatus)*: juvenile trapping has helped document relative abundance and life history characteristics of this species. Pacific lamprey are difficult to sample, and their life history and status in the state is mostly unknown. This information has helped biologists develop further research needs and priorities for this species in the Clearwater River drainage.

Steelhead: steelhead caught in South Fork Clearwater River drainage juvenile traps were PIT tagged and sampled for genetic analyses. These data helped the National Biological Service evaluate Selway and Dworshak stock steelhead as an appropriate broodstock in the South Fork Clearwater drainage. Steelhead caught in all juvenile traps were also PIT tagged to help determine life history characteristics as part of a steelhead supplementation study (IDFG).

Sockeye salmon: Data collected from juvenile sockeye salmon trapped on the upper Salmon River contribute to research being conducted by IDFG and SBT.

– Other projects:

Temperature monitoring on Clear Creek (USFS). Monitoring effects of habitat improvement on Pete King Creek (USFS). Fish health survey (USFWS).

Overview

The scope of the ISS project is ambitious. In addition, the first five years required great effort to develop methodologies and protocols, many of which were not specifically addressed in the experimental design. The compilation of baseline data (including caveats, deviations, etc.) from these first five years was a necessary first step on which to base further data reporting and analyses. We plan a follow-up report, which will address potential data analyses. This second report will require more extensive coordination with statisticians and managers to help determine which analyses are feasible given our data set from the first five years. Where feasible, we plan to analyze smolt-to-adult returns, smolts per redd, and survival between various life stages in this second report. Input will also be solicited from statisticians and managers to determine how much of the data collection status quo should be maintained (i.e., which of the original study design questions are still feasible to answer, even though the project will continue to be constrained by low adult escapement). Other potential topics may include possible changes in focus given the continued decline of chinook salmon runs to Idaho.

While compiling data from the first five years, several points became evident. First, consistency in data collection methodology was a challenge. It is imperative that data be collected in a consistent manner within and among years and among cooperators so it is comparable. Second, we became aware of the extensive amount of data this project has and will continue to produce. A large amount of future effort will need to be directed to building and maintaining databases for this study. As part of the consistency challenge, data from all cooperators will need to be stored in, and accessed from, a central location. Protocols will need to be developed to build the central database, taking into consideration the various potential uses and users of the data. Protocols will also be needed to insure the central database receives all corrections and additions individual cooperators may make to their own working versions. These tasks will require at least one full time database manager. Such a central database will be crucial to data consistency within the project and to the credibility of ISS as other researchers request and use ISS data.

The study design also includes genetics monitoring to help evaluate supplementation. Baseline samples were collected and analyzed early in the study (Marshall 1992, 1994). Genetic differences found between years within ISS populations suggest that a baseline profile may have limited utility for monitoring changes resulting from supplementation (Marshall 1994). However, allele frequencies could become temporally stable if the size of a population increases due to supplementation. This effect could be measured against the baseline condition (Marshall 1994).

The continued decline of chinook salmon runs to Idaho is the major factor affecting evaluation of supplementation efforts. Smolt-to-adult survival rates remain below the 2%-6% needed for recovery (IDFG 1998). In 1992, the Salmon River stocks of chinook salmon were listed by National Marine Fisheries Service as threatened. Escapement in the Clearwater River basin is declining as well. These declines are caused mainly by dams on the lower Snake and Columbia rivers. The dams cause direct, indirect, or delayed mortality, mainly to emigrating juveniles (IDFG 1998, Nemeth and Kiefer 1999). This ISS project was designed with the assumption that there would be second and third generation supplementation treatments to analyze, but low adult returns will continue to limit broodstock development.

We reemphasize that supplementation cannot mitigate for mortality problems in the Lower Snake and Columbia River corridors. Our challenge is to develop methods and analyses that will allow us to reach reasonable conclusions regarding hatchery supplementation under the constraint of low smolt-to-adult survival. Continuing this project still provides cooperators with the best means of assessing one of the few available tools (supplementation) for potentially rebuilding declining upriver runs of salmon to Idaho. Other potential project benefits include additional life history data and baseline data for evaluating various recovery actions for listed Snake River salmon. This project is also identifying critical data needs regarding juvenile fish sample size requirements for PIT tagging studies and adult return numbers required to conduct analysis. Information gained on broodstock management and release strategies could be applied to potential future hatchery operations to help recover stocks, provided mortality factors in the migration corridor are reduced.

One final benefit of this project is the cooperative effort it involves among different groups working to conserve a common resource. This effort has occurred at both the inter- and intra-agency level and at the field and administrative level. This project, and chinook salmon conservation in Idaho, depends on the continued cooperation and commitment of the various entities involved.

Considerations for Future Study Direction

Listed below are important issues and tasks to emphasize during the next stage of the study:

– Maintain consistency in data collection methodology
– Maintain quality control on data
– Accuracy and precision in total adult escapement estimates, including contribution by brood year
– Development of a central database
– Careful scrutiny over releases and outplants not identified in the study design (i.e., the need to maintain the controlled nature of the study design).
– Work with a statistician to determine which analyses outlined in the study design are still feasible, and to determine if changes are needed in data collection methods, type of data to collect, etc.
– Natural rearing evaluation
– Review and prioritize which production and productivity parameters will be most useful in evaluating supplementation

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APPENDICES

Appendix A. Bibliography of Idaho Supplementation Studies Reports covering 1991-1996.

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Appendix B. Chinook salmon stocking in Idaho Supplementation Studies treatment streams for brood years 1991-1995. Mark: RV = right pelvic fin clip, LV = left pelvic fin clip, E = elastomere injection, AD = adipose fin clip. Broodstock sources: RPR = Rapid River, CRR = Crooked River, RDR = Red River, DWO = Dworshak, POW = Powell, SFS = South Fork Salmon River, PAR = Pahsimeroi River (summer run), EFS = East Fork Salmon River, SAL = Salmon River. Rearing Facilities: CAFH = Clearwater Anadromous Fish Hatchery, DNFH = Dworshak National Fish Hatchery, RRFH = Rapid River Fish Hatchery, MFH = McCall Fish Hatchery, PFH = Pahsimeroi Fish Hatchery, SFH = Sawtooth Fish Hatchery.

Basin Stream Brood Year	Proposed Annual Treatment	Date Released	Life Stage Released	Number Released	Number PIT Tagged	Mark	Average Fork Length (mm)	Broodstock Source	Rearing Facility
Clearwater River Basin									
Lolo/Yoosa Creek	175,000 presmolts								
1991-1995				0					
Newsome Creek	100,000 presmolts								
1995				0					
1994				0					
1993		04/10-11/95	smolt	189,612	1,200	RV	130	RPR	CAFH
1992				0					
1991				0					
Crooked River	400,000 presmolts								
1995				0					
1994				0					
1993		9/19/94	presmolt	199,255	1,000	RV	108	CRR	CAFH
1992				0					
1991				0					
American River	128,000 smolts								
1995				0					
1994				0					
1993		4/5-10/95	smolt	221,449	1,199	RV	112	RPR	CAFH
1992				0					
1991				0					
Red River	80,000 presmolts								
1995				0					
1994				0					

Appendix B. Continued.

Basin Stream Brood Year	Proposed Annual Treatment	Date Released	Life Stage Released	Number Released	Number PIT Tagged	Mark	Average Fork Length (mm)	Broodstock Source	Rearing Facility
Red River continued.									
1993		09/23/94	presmolt	79,747	1,000	LV	96	RDR	CAFH
1992		10/12/93	presmolt	7,971[a]	300	RV	119	RDR	CAFH
		10/12/93	presmolt	14,275[b]	700	RV	119	RDR	CAFH
1991		10/19/92	presmolt	6,000	954	LV	132	RDR	CAFH
Clear Creek	49,000 smolts								
1995				0					
1994		04/12/96	smolt	49,674	503	LV	142	KOO	KNFH
1993		04/12/95	smolt	49,319	494	RV	105	KOO	KNFH
1992				0					
1991				0					
Pete King Creek	13,000 parr								
1995				0					
1994				0					
1993		07/05/94	parr	15,080	998	RV	78	POW	CAFH
1992		08/06/93	parr	12,000	1000	LV	104	POW	CAFH
1991				0					
Squaw Creek	12,000 parr								
1995				0					
1994				0					
1993		07/05/94	parr	14,977	1,001	RV	78	POW	CAFH
1992		08/05/93	parr	12,000	998	LV	103	POW	CAFH
1991		07/23/92	parr	10,126	699	RV	65	RPR	RRFH
Papoose Creek	50,000 smolts								
1995				0					
1994				0					
1993		04/05/95	smolt	55,300	499	RV	120	RPR	CAFH
1992		04/15/94	smolt	16,110	499	LV	150	POW	CAFH
1991				0					

Appendix B. Continued.

Basin Stream Brood Year	Proposed Annual Treatment	Date Released	Life Stage Released	Number Released	Number PIT Tagged	Mark	Average Fork Length (mm)	Broodstock Source	Rearing Facility
Colt Killed Creek	80,000 parr								
1995				0					
1994				0					
1993		7/6-8/94	parr	99,808	998	RV	78	POW	CAFH
1992		8/4-5/93	parr	79,988	1,000	LV	103	POW	CAFH
1991		7/23/92	parr	90,125	1,399	RV	65	RPR	RRFH
Big Flat Creek	40,000 parr								
1995				0					
1994				0					
1993		7/6-8/94	parr	49,954	997	RV	78	POW	CAFH
1992		8/5-6/93	parr	40,875	1,000	LV	103	POW	CAFH
1991				0					
Crooked Fork Creek[c]									
1991		09/05/92	presmolt	7,800	0[d]	LV	120	POW	CAFH
Salmon River Basin									
Slate Creek	240,000 presmolts								
1991-1995				0					
South Fork Salmon River	238,000 smolts								
1995		3/19-21/97	smolt	63,355	0	E	-	SFS	MFH
1994		4/11-12/96	smolt	234,314[e]	0	LV	-[f]	SFS	MFH
1993		4/6-8/95	smolt	311,814	499	RV	118	SFS	MFH
1992		4/9-10/94	smolt	235,939	498	LV	117	SFS	MFH
1991		4/21-22/93	smolt	132,750	500	RV	130	SFS	MFH
Lemhi River	50,000 smolts and 60,000 parr								
1991-1995				0					
Pahsimeroi River	134,000 smolts								
1995				0					
1994				0					
1993		4/11-14/95	smolt	147,429[g]	493	RV	126	PAR	PFH

Appendix B. Continued.

Basin Stream Brood Year	Proposed Annual Treatment	Date Released	Life Stage Released	Number Released	Number PIT Tagged	Mark	Average Fork Length (mm)	Broodstock Source	Rearing Facility
Pahsimeroi River continued.									
1992		4/8-12/94	smolt	46,473[h]	998[i]	LV	117	PAR	PFH
1991		4/14-19/93[j]	smolt	83,953	600[k]	LV	143	PAR	PFH
East Fork Salmon R.	173,000 smolts								
1995				0					
1994				0					
1993		03/28/95	smolt	48,845[l]	499	LV	126	EFS	SFH
1992		04/08/94	smolt	12,368	387	RV	111	EFS	SFH
1991		04/20/93	smolt	35,172	350	LV	122	EFS	SFH
West Fork Yankee Fork Salmon River	61,000 smolts								
1995				0					
1994				0					
1993		10/19-29/94	presmolt	25,025	1,000	AD	97	SAL	SFH
1992				0					
1991				0					
Upper Salmon River	500,000 smolts								
1995		4/17/97	smolt	4,650	1440	AD	-	SAL	SFH
1994		3/26/96	smolt	25,006	763	AD	126	SAL	SFH
1993		3/27/95	smolt	103,507	779	RV	131	SAL	SFH
		10/24/94	presmolt	102,086	811	RV	131	SAL	SFH
1992		4/9/94	smolt	72,300	562	LV	111	SAL	SFH
1991		4/20/93	smolt	51,819	800	RV	119	SAL	SFH
		10/2-7/92	presmolt[m]	31,820	800	RV	129	SAL	SFH
		10/2-7/92	presmolt[n]	58,534	800	RV	119	SAL	SFH
		10/2-7/92	presmolt[o]	104,890	800	RV	112	SAL	SFH

[a] High bacterial kidney disease (BKD) rating
[b] Low BKD rating
[c] Crooked Fork Creek was originally designated a treatment stream and received one stocking of presmolts in fall 1992.
[d] 88 hatchery fish were tagged after being caught in the Crooked Fork Creek screw trap.
[e] Includes 9,356 high BKD fish.
[f] Weighed but not measured

Appendix B. Continued.

[g] A total of 5,757 of these fish were from positive BKD females.
[h] Includes 1129 fish from positive BKD females
[i] Total number Passive Integrated Transponder (PIT) tagged out of a group of 126,790 fish; of the 126,790 fish, 46,473 were LV clipped, but number of LV clipped fish receiving PIT tags is unknown
[j] Released into the Pahsimeroi ponds.
[k] Total number PIT tagged out of a group of 375,000 fish; of the 375,000 fish, 83,953 were LV clipped, but number of LV clipped fish receiving PIT tags is unknown; this group of 375,000 fish also had whirling disease present.
[l] Includes 17,595 BKD fish.
[m] Low density rearing (part of another study).
[n] Medium density rearing (part of another study).
[o] High density rearing (part of another study).

Appendix C. Summary of chinook salmon parr population estimates and densities obtained from snorkeling in the Clearwater and Salmon River drainages, brood years 1990-1995. Relative Confidence Interval = the 90% confidence interval as a percent of the estimate.[a,b]

Stream & Brood Year	Year Sampled	Population Estimate	±90% CI	±Relative Confidence Interval	% of Sampling Strata Snorkeled	Observed Density #fish/100m^2
Clearwater River Drainage						
Lolo Creek						
1995	1996	612	746	122%	6.8	0.23
1994	1995	1,594	1,796	113%	6.4	0.68
1993	1994	21,541	6,433	30%	6.6	8.62
1992	1993	4,877	4,248	87%	6.7	1.66
1991	1992	7,000	3,868	55%	6.6	2.33
Eldorado Creek						
1995	1996	0	-	-	3.9	0.00
1994	1995	90	145	161%	4.4	0.07
1993	1994	2,204	2,658	121%	4.7	1.62
1992	1993	0	-	-	3.9	0.00
1991	1992	62	164	265%	4.8	0.04
Yoosa Creek						
1995	1996	48	14	29%	8.1	0.03
1994	1995	0	-	-	7.9	0.00
1993	1994	2,977	2,225	75%	7.8	8.82
1992	1993	0	-	-	8.0	0.00
1991	1992	510	461	90%	7.8	1.26
Newsome Creek						
1995	1996	0	-	-	4.2	0.00
1994	1995	36	63	175%	4.1	0.03
1993	1994	106,001[c]	23,952	23%	4.2	65.41
1992	1993	2,383	1,471	62%	3.7	1.56
1991	1992	119	217	182%	2.5	0.10
1990	1991	5,692	2,590	46%	6.8	4.91
Crooked River						
1995	1996	0	-	-	7.5	0.00
1994	1995	4,601	2,521	55%	7.9	1.70
1993	1994	45,567	12,512	28%	7.9	19.50
1992	1993	24,435	14,835	61%	9.5	12.35
1991	1992	415	213	51%	7.6	0.19
1990	1991	0	-	-	7.0	0.00
American River						
1995	1996	164	285	174%	2.0	0.06
1994	1995	67	129	193%	1.5	0.03
1993	1994	206,470[d]	23,735	12%	4.7	93.04
1992	1993	1,599	851	53%	3.9	0.59
1991	1992	10,330	3,822	37%	3.4	3.52
1990	1991	4,556	1,826	40%	4.0	1.79

Appendix C. Continued.

Stream & Brood Year	Year Sampled	Population Estimate	±90% CI	±Relative Confidence Interval	% of Sampling Strata Snorkeled	Observed Density (#fish/100m^2)
Red River						
1995	1996	1,463	513	35%	6.7	0.57
1994	1995	4,456	2,534	57%	4.2	1.17
1993	1994	101,742	15,256	15%	7.6	25.78
1992	1993	11,348	2,576	23%	6.6	1.97
1991	1992	10,417	2,984	29%	8.2	5.17
1990	1991	7,886	10,166	129%	ND	8.20
Clear Creek						
1995	1996	34	45	132%	0.9	0.02
1994	1995	2,242	1,163	52%	0.9	1.18
1993	1994	14,788	5,723	39%	0.9	6.30
1992	1993	7,142	4,117	58%	0.9	2.63
1991	1992	6,218	2,426	39%	0.9	2.86
1990	1991	25,311	7,372	29%	0.9	20.66
Pete King Creek						
1995	1996	82	58	71%	1.2	0.17
1994	1995	116	105	91%	1.2	0.19
1993	1994[e]	5,143	2,869	56%	1.2	11.51
1992	1993	25	34	136%	1.2	0.52
1991	1992	146	199	136%	1.2	0.22
1990	1991	1,569	2,585	165%	3.1	2.18
Squaw Creek						
1995	1996	0	-	-	7.9	0.00
1994	1995	0	-	-	7.5	0.00
1993	1994	11,818	11,116	94%	7.8	15.69
1992	1993	0	-	-	8.0	0.00
1991	1992	320	533	167%	8.1	0.82
Papoose Creek						
1995	1996	38	49	129%	9.0	0.15
1994	1995	0	-	-	10.2	0.00
1993	1994	8,017	1,714	21%	9.6	26.63
1992	1993	299	171	57%	8.8	14.40
1991	1992	0	-	-	9.6	0.00
Colt Killed Creek and Big Flat Creek						
1995	1996[f]	0	-	-	0.8	0.00
1994	1995	NS	-	-	-	-
1993	1994	4,431	6,150	139%	6.2	1.01
1992	1993	141	169	120%	4.1	0.46
1991	1992	2,570	2,298	89%	4.4	1.42
1990	1991	1,910	1,572	82%	2.2	1.36
Crooked Fork Creek and Brushy Fork Creek						
1995	1996[g]	610	645	106%	12.1	0.25
1994	1995	2,257	1,122	50%	3.7	0.37
1993	1994	63,620	13,032	21%	4.2	7.72
1992	1993	17,415	8,870	51%	4.0	1.45

Appendix C. Continued.

Stream & Brood Year	Year Sampled	Population Estimate	±90% CI	±Relative Confidence Interval	% of Sampling Strata Snorkeled	Observed Density (#fish/100m^2)
Crooked Fork Creek and Brushy Fork Creek continued.						
1991	1992	12,403	3,881	31%	4.0	1.80
1990	1991	28,875	31,298	108%	3.9	2.02
White Cap Creek						
1995	1996	NE	NE	NE	1.2	0.29
1994	1995	NE	NE	NE	1.4	0.02
1993	1994	12,357	7,237	59%	4.4	5.67
1992	1993	6,130	3,133	51%	2.9	2.17
1991	1992	892	660	74%	1.9	0.16
Salmon River Drainage						
Slate Creek						
1995	1996	NS	-	-	-	-
1994	1995	430	176	41%	3.9	0.37
1993	1994	7,714	3456	45%	5.5	8.07
1992	1993	1,293	1203	93%	3.2	1.22
1991	1992	1,211	838	69%	3.2	1.11
South Fork Salmon River						
1995	1996	6,381	3,956	62%	11.1	3.2
1994	1995	3,796	1,746	46%	11.5	1.3
1993	1994	144,115	24,499	17%	10.0	59.9
1992	1993	12,521	6,385	51%	7.1	10.0
1991	1992	8,820	3,704	42%	5.1	4.3
1990	1991	28,624	5,985	21%	4.4	11.3
Secesh River						
1995	1996	3,206	2,019	63%	3.5	1.29
1994	1995	4,233	2,832	67%	3.3	1.31
1993	1994	13,828	5,491	40%	3.9	4.93
1992	1993	8,728	7,033	81%	2.6	3.99
1991	1992	15,659	6,733	43%	2.6	7.38
Lake Creek						
1995	1996	884	772	87%	2.6	0.80
1994	1995	2,483	185	8%	3.0	0.91
1993	1994	16,405	8,895	54%	2.9	10.88
1992	1993	4,826	7,535	156%	2.3	6.48
1991	1992	4,440	3,121	70%	2.3	3.14
Johnson Creek						
1995	1996[h]	NS	-	-	-	-
1994	1995[i]	5,965	4,957	83%	4.5	1.2
1993	1994	121,383	44,910	37%	5.4	16.1
1992	1993	19,272	10,601	55%	3.4	3.4
1991	1992	9,760	9,505	97%	5.1	1.7

Appendix C. Continued.

Stream & Brood Year	Year Sampled	Population Estimate	±90% CI	±Relative Confidence Interval	% of Sampling Strata Snorkeled	Observed Density (#fish/100m²)
Marsh Creek						
1995	1996	NS	-	-	-	-
1994	1995	502	146	29%	7.3	1.22
1993	1994	29,007	9,020	31%	7.7	24.3
1992	1993	16,717	5,694	34%	7.9	10.63
1991	1992	15,665	3,706	24%	7.5	19.5
Bear Valley Creek						
1995	1996	11	22	200%	8.5	.001
1994	1995	535	294	55%	9.2	0.2
1993	1994	25,451	6,108	24%	10.3	10.1
1992	1993	5,259	3,470	66%	7.8	1.2
1991	1992	9,153	4,668	51%	3.5	3.4
North Fork Salmon River						
1995	1996	NS	-	-	-	-
1994	1995	374	441	118%	1.3	0.16
1993	1994	23,639	8,982	38%	4.7	10.9
1992	1993	3,540	2,547	72%	4.2	1.3
1991	1992	12,422	7,634	62%	4.5	3.75
1990	1991	8,508	2,730	32%	4.2	2.35
Lemhi River						
1995	1996	3,116	4,767	153%	1.7	0.50
1994	1995	11,148	11,559	104%	2.3	1.2
1993	1994	10,793	6,681	62%	2.9	1.8
1992	1993	2,571	1,744	68%	2.7	0.44
1991	1992	NS	-	-	-	-
1990	1991	12,022[j]	5,683	47%	ND	3.59
Pahsimeroi River						
1995	1996	NS	-	-	-	-
1994	1995	NS	-	-	-	-
1993	1994	NS	-	-	-	-
1992	1993	6,305	5,741	91%	7.6	1.9
1991	1992	41,600	35,520	85%	5.3	16.81
1990	1991	21,396	15,402	72%	5.6	9.6
East Fork Salmon River						
1995	1996	NE[k]	-	-	0.7	0.0
1994	1995	464	274	59%	6.9	0.2
1993	1994	9,176	4,863	53%	13.0	4.6
1992	1993	161	258	160%	10.0	0.1
1991	1992	NS	-	-	-	-
Herd Creek						
1995	1996	0[l]	-	-	1.0	0.0
1994	1995	190	124	65%	4.7	0.2
1993	1994	39,944	13,580	34%	5.4	50.3
1992	1993	863	975	113%	3.8	0.7
1991	1992	16,333	6,369	39%	2.2	21.0

Appendix C. Continued.

Stream & Brood Year	Year Sampled	Population Estimate	±90% CI	±Relative Confidence Interval	% of Sampling Strata Snorkeled	Observed Density (#fish/100m^2)
West Fork Yankee Fork Salmon River						
1995	1996	0[l]	-	-	2.9	0.0
1994	1995	4,039	1,696	42%	10.1	2.9
1993	1994	13,465	4,443	33%	10.3	11.9
1992	1993	113	139	123%	6.7	0.1
1991	1992	8,285	8,672	105%	3.9	5.0
1990	1991	13,179	8,688	66%	3.4	8.4
Valley Creek						
1995	1996	508	731	144%	1.4	0.06
1994	1995	119	69	58%	5.6	0.1
1993	1994	136,046	21,767	16%	6.7	34.0
1992	1993	4,126	2,063	50%	5.2	1.0
1991	1992	11,874	3,443	29%	4.6	5.1
Upper Salmon River and Alturas Lake Creek						
1995	1996	345[m]	594	172%	3.9	0.04
1994	1995	12,242[n]	6,670	55%	5.7	0.76
1993	1994	152,172[o]	55,332	36%	5.6	12.11
1992	1993	9,334[o]	6,757	72%	5.8	0.60
1991	1992	44,996[p]	30,276	67%	5.9	3.70

[a] Not all streams were snorkeled in summer 1991.
[b] NS = No snorkeling; NE = No estimate (too few fish sampled to calculate an estimate); ND = No data.
[c] 125 adult pairs were outplanted in summer 1993 from Rapid River.
[d] 150 adult pairs were outplanted in summer 1993 from Rapid River.
[e] Pete King Creek was stocked by IDFG prior to snorkel survey, so actual numbers of natural fish is unknown.
[f] Colt Killed Creek only.
[g] Brushy Fork Creek only.
[h] <20 chinook parr were observed in some of the best habitat and when snorkeling index stations (General Parr Monitoring), therefore, effort to estimate parr population was abandoned.
[i] High flows prevented snorkeling Strata II & IV. All calculations are made for Strata I & III only. Upper boundary used for Stratum I was Buckhorn Campgrounds, not headwater for 1995 only.
[j] Population estimate obtained by electrofishing.
[k] Only General Parr Monitoring sites were snorkeled because zero redds were observed in 1995. Not enough of the stream was snorkeled to determine if there were no chinook parr in the system, thus, no estimate was made.
[l] No chinook parr were observed in 1996, however, effort was reduced compared to previous years.
[m] Includes Pole Creek.
[n] Includes Fourth of July Creek, Frenchman Creek, Gold Creek, Huckleberry Creek, Pole Creek, Smiley Creek, and Williams Creek.
[o] Includes Beaver Creek, Champion Creek, Fourth of July Creek, Frenchman Creek, Gold Creek, Huckleberry Creek, Pole Creek, Smiley Creek, and Williams Creek.
[p] Includes same streams as 1993 and 1994 except Williams Creek.

Appendix D. Summary of juvenile chinook salmon trapping and emigration estimates for Idaho Supplementation Studies streams in the Clearwater and Salmon River drainages, brood years 1991-1994.

Drainage Stream & Brood Year	Trap Start Date	Trap End Date	Total Number of Days Trapped[a]	Number of Unmarked Fish Trapped	Number Marked and Released Upstream of Trap	Number of Recaptures	Trap Efficiency	Emigrant Estimate	90% CI
Clearwater River Drainage									
Lolo Creek									
1994	1/3/96	6/27/96	78	417	22	10	0.478	885	620-1,282
	7/6/95	12/22/95	57	418	64	15	0.246	1,727	1,215-2,470
1993	1/18/95	6/30/95	111	1,710	502	92	0.185	9,212	7,920-10,840
	8/25/94	12/30/94	89	8,291	309	75	0.245	33,883	28,593-40,014
1992	1/19/94	6/23/94	81	714	60	24	0.410	1,742	1,370-2,247
	8/28/93	11/23/93	61	291	16	10	0.670	450	341-616
1991	3/9/93	6/17/93	66	253	60	24	0.410	612	476-790
	11/12/92	11/24/92	12	231	140	55	0.397	583	480-702
Crooked River									
1994	3/14/96	6/11/96	89	170	157	45	0.291	578	461-715
	8/30/95	11/2/95	64	36	34	4	0.143	245	127-455
1993	3/15/95	6/6/95	82	5,343	2,061	736	0.357	14,942	14,082-15,729
	8/31/94	11/9/94	70	6,703	1,172	424	0.362	18,506	17,294-19,763
1992	3/18/94	6/15/94	89	1,729	1,649	781	0.474	3,658	3,482-3,845
	8/20/93	11/3/93	75	368	357	20	0.059	6,238	4,398-8,807
1991	3/13/93	6/9/93	88	100	88	52	0.596	167	140-202
	9/2/92	11/11/92	70	85	84	17	0.212	399	275-574
Red River									
1994	3/12/96	6/30/96	101	152	149	19	0.133	1,129	783-1,613
	8/30/95	12/31/95	124	556	553	109	0.199	2,802	2,395-3,272
1993	3/14/95	5/31/95	76	1,900	1,276	210	0.165	11,479	10,298-12,737
	8/26/94	10/12/94	43	3,256	1,564	306	0.196	16,606	15,152-18,078
1992	3/29/94	5/25/94	57	397	396	49	0.126	3,161	2,514-3,981
	8/25/93	11/8/93	75	1,001	1,000	155	0.156	6,429	5,680-7,377
1991	3/18/93	6/8/93	81	583	560	99	0.178	3,271	2,771-3,880
	9/18/92	10/27/92	39	264	264	4	0.019	13,774	6,890-34,557

Appendix D. Continued.

Drainage Stream & Brood Year	Trap Start Date	Trap End Date	Total Number of Days Trapped[a]	Number of Unmarked Fish Trapped	Number Marked and Released Upstream of Trap	Number of Recaptures	Trap Efficiency	Emigrant Estimate	90% CI
Clear Creek[b]									
1994	3/1/96	6/30/96	122	17	0	—	—	—	—
	7/1/95	8/13/95	44	9	0	—	—	—	—
1993	3/14/95	6/29/95	60	64	0	—	—	—	—
	7/1/94	7/14/94	14	12	0	—	—	—	--
[c]	9/14/94	11/11/94	59	160	0	—	—	—	—
1992	3/14/94	6/26/94	105	30	0	—	—	—	—
	7/1/93	8/9/93	40	63	0	—	—	—	—
1991	5/13/93	6/30/93	49	23	0	—	—	—	—
Crooked Fork Creek									
1994	3/22/96	6/30/96	79	12	11	1	0.167	64	24-156
	8/27/95	11/2/95	67	368	338	45	0.136	2,719	2,129-3,465
1993	3/19/95	6/8/95	76	164	161	24	0.154	1,053	772-1,432
	8/21/94	11/7/94	78	12,778	2,693	440	0.164	77,977	72,351-83,326
1992	3/16/94	6/1/94	73	371	338	19	0.059	3,210	4,371-8,717
	8/20/93	11/14/93	85	1,967	1,861	351	0.189	10,404	9,513-11,309
1991	3/17/93	6/8/93	79	313	303	15	0.053	5,960	4,013-9,120
	9/16/92	11/11/92	56	882	223	86	0.388	2,265	1,950-2,616
<u>Salmon River Drainage</u>									
South Fork Salmon River									
1994	3/20/96	5/15/96	53	211	210	13	0.070	3,223	2,060-4,853
	8/29/95	11/2/95	61	1,959	1,108	176	0.160	12,271	10,891-14,849
1993	4/3/95	6/2/95	55	204	190	9	0.050	3,802	2,348-6,080
[d]	8/30/94	10/25/94	56	--	--	--	--	--	--
1992	3/16/94	6/1/94	77	2,841	1,875	563	0.300	9,454	8,843-10,023
	8/24/93	11/8/93	74	5,756	4,653	847	0.180	31,591	29,844-33,183
1991	4/3/93	6/14/93	70	173	170	16	0.100	1,754	1,161-2,636
	9/14/92	11/5/92	52	735	621	140	0.227	3,238	2,843-3,657
Marsh Creek									
1994	3/16/96	5/29/96	66	3	3	1	0.500	6	1-12
	8/22/95	11/13/95	83	277	275	95	0.348	796	679-919
1993	3/30/95	6/8/95	67	350	220	111	0.507	691	611-783
[e]	8/19/94	11/2/94	65	11,243	--	--	--	14,420	--

Appendix D. Continued.

Drainage Stream & Brood Year	Trap Start Date	Trap End Date	Total Number of Days Trapped[a]	Number of Unmarked Fish Trapped	Number Marked and Released Upstream of Trap	Number of Recaptures	Trap Efficiency	Emigrant Estimate	90% CI
Marsh Creek continued.									
1992	3/16/94	6/1/94	63	167	157	15	0.101	1,644	1,112-2,456
	8/19/93	11/14/93	87	9,674	6,618	3,570	0.540	17,932	17,533-18,381
1991	4/8/93	6/1/93	49	177	173	46	0.270	651	519-816
Lemhi River									
1994	3/12/96	6/30/96	91	74	39	7	0.200	374	213-647
	9/2/95	11/27/95	85	354	181	40	0.225	1,575	1,237-2,025
1993	3/17/95	6/1/95	74	204	198	31	0.161	1,266	944-1,673
	7/1/94	11/18/94	140	2,101	1,422	312	0.220	9,547	8,726-10,389
1992	3/11/94	6/30/94	111	74	63	8	0.141	532	310-909
	9/1/93	12/6/93	96	1,948	734	134	0.184	10,582	9,287-12,036
1991	2/28/93	5/31/93	92	468	286	133	0.467	1,005	894-1,132
	9/1/92	11/24/92	84	1,381	691	57	0.084	16,466	13,359-20,495
Pahsimeroi River[f]									
1994	3/12/96	6/30/96	106	410	404	54	0.136	3,018	2,401-3,739
	8/30/95	12/8/95	93	321	262	18	0.072	4,470	3,049-6,519
1993	3/15/95	6/21/95	85	1,871	1,058	99	0.094	19,798	17,099-23,154
	9/9/94	12/12/94	88	1,955	1,931	230	0.120	16,365	14,730-18,219
1992	3/3/94	6/1/94	90	939	494	43	0.089	10,500	8,363-13,307
	8/20/93	12/15/93	117	409	318	33	0.107	3,815	2,878-5,030
1991	4/3/93	6/2/93	58	106	106	2	0.028	3,543	1,498-9,737
	9/14/92	12/11/92	76	468	304	20	0.069	6,788	4,869-9,882
East Fork Salmon River									
1994	3/4/96	5/30/96	84	153	150	23	0.159	974	706-1,350
	8/8/95	11/11/95	95	113	110	9	0.090	1,230	754-1,906
1993	3/7/95	5/31/95	81	367	353	55	0.158	2,304	1,866-2,840
	8/15/94	11/22/94	96	643	542	57	0.107	6,011	4,842-7,391
1992	3/14/94	5/27/94	73	21	21	5	0.273	79	40-149
	8/16/93	11/21/93	96	211	198	36	0.186	1,140	874-1,489
1991	4/7/93	5/21/93	42	225	217	28	0.133	1,701	1,243-2,249

Appendix D. Continued.

Drainage Stream & Brood Year	Trap Start Date	Trap End Date	Total Number of Days Trapped[a]	Number of Unmarked Fish Trapped	Number Marked and Released Upstream of Trap	Number of Recaptures	Trap Efficiency	Emigrant Estimate	90% CI
Upper Salmon River									
1994	3/8/96	5/16/96	63	257	246	16	0.069	3,727	2,513-5,578
	8/24/95	11/12/95	80	562	532	21	0.041	13,588	9,783-19,455
1993	3/10/95	6/6/95	88	629	626	33	0.054	11,567	8,858-15,466
	8/4/94	11/8/94	96	1,138	1,071	111	0.104	10,921	9,403-12,853
1992	3/9/94	6/9/94	91	239	235	14	0.064	3,756	2,461-5,514
	8/5/93	11/8/93	95	101	100	0	0.000	-	-
1991	4/3/93	6/9/93	67	165	154	8	0.058	2,842	1,664-4,676
	8/21/92	11/4/92	75	776	743	88	0.120	6,466	5,471-7,685

[a] Traps did not operate on some days, usually due to mechanical failure, high water, obstruction with debris, or ice.
[b] All fish were released downstream; no trap efficiency was attempted.
[c] Juvenile weir was used.
[d] No estimate was made because the number of unmarked fish trapped and total number of recaptures is unknown.
[e] Marsh Creek fall 1994 data from Nemeth, et al. 1996.
[f] Spring emigration estimates for the Pahsimeroi River may include more than one year-class of fish.

Appendix E. Adult escapement numbers by return year and brood year for Idaho Supplementation Studies streams, 1992-1996.

Stream	Return Year	% 1.1	% 1.2	%1.3	Age comp. method[a]	Total number of redds	Estimated Escapement	Total number of adult returns by brood year				
								BY	Total	1.1	1.2	1.3
Lolo/Yoosa Cr.												
	96	27	67	6	B	21	67.2	93	18.1	18.1	-	-
	95	47	24	29	B	6	19.2	92	54.0	9.0	45.0	-
	94	1	42	57	B	7	22.4	91	8.9	0.2	4.6	4.0
	93	1	46	53	B	23	76.8	90	15.7	0.7	9.4	5.6
	92	4	86	10	B	19	60.8					
Eldorado Cr.												
	96	-	-	-	N/A	0	0	93	0	0	-	-
	95	-	-	-	N/A	0	0	92	0	0	0	-
	94	-	-	-	N/A	0	0	91	0	0	0	0
	93	-	-	-	N/A	2	6.4	90	0.1	0.1	0	0
	92	-	-	-	N/A	0	0					
Newsome Cr.												
	96	27	67	6	B	4	12.8	93	3.5	3.5	-	-
	95	-	-	-	N/A	0	0	92	8.6	0.0	8.6	-
	94	-	-	-	N/A	0	0	91	0.8	0.0	0.0	0.8
	93	3	38	59	C	55	176[b]	90	5.3	5.3	0.0	0.0
	92	4	86	10	B	2	6.4					
Crooked River												
	96	30.8	68.9	0.3	W	4	12.8	93	3.9	3.9	-	-
	95	-	-	-	N/A	0	0	92	8.8	0.0	8.8	-
	94	1	42	57	B	4	12.8	91	0.2	0.1	0.0	0.0
	93	1	46	53	B	54	172.8	90	7.1	1.7	5.4	0.0
	92	4	86	10	B	54	172.8					
American River												
	96	27	67	6	B	9	28.8	93	7.8	7.8	-	-
	95	-	-	-	N/A	0	0	92	19.3	0.0	19.3	-
	94	1	42	57	B	9	28.8	91	2.0	0.3	0.0	1.7
	93	0	30	70	C	209	668.8[c]	90	12.1	0.0	12.1	0.0
	92	4	86	10	B	5	16					
Red River												
	96	14.5	85.5	0	W	41	131.2	93	19.0	19.0	-	-
	95	47	24	29	B	17	54.4	92	137.7	25.6	112.2	-
	94	1	42	57	B	23	73.6	91	13.8	0.7	13.1	0.0
	93	0	25	75	C	69	220.8	90	46.7	0.0	30.9	15.8
	92	5	95	0	C	44	140.8					
Clear Cr.												
	96	45	54	1	W	3	9.6	93	4.3	4.3	-	-
	95	-	-	-	N/A	0	0	92	5.2	0.0	5.2	-
	94	0.4	41.4	58.2	W	1	3.2	91	0.1	0.0	0.0	0.1
	93	0.9	64.1	35	W	7	22.4	90	1.5	0.2	1.3	0.0
	92	4.8	82.1	13.1	W	1	3.2					

Appendix E. Continued.

Stream	Return Year	% 1.1	% 1.2	%1.3	Age comp. method[a]	Total number of redds	Estimated Escapement	Total number of adult returns by brood year: BY	Total	1.1	1.2	1.3
Pete King Cr.												
	96	-	-	-	N/A	0	0	93	0	0	-	-
	95	-	-	-	N/A	0	0	92	0	0	0	-
	94	-	-	-	N/A	0	0	91	0	0	0	0
	93	-	-	-	N/A	0	0	90	0	0	0	0
	92	-	-	-	N/A	0	0					
Squaw Cr.												
	96	27	67	6	B	1	3.2	93	0	0	-	-
	95	-	-	-	N/A	0	0	92	0	0	0	-
	94	-	-	-	N/A	0	0	91	0	0	0	0
	93	-	-	-	N/A	0	0	90	0	0	0	0
	92	4	86	10	B	1	3.2					
Papoose Cr.												
	96	27	67	6	B	7	22.4	93	6.0	6.0	-	-
	95	47	24	29	B	1	3.2	92	16.5	1.5	15.0	-
	94	-	-	-	N/A	0	0	91	2.1	0.0	0.8	1.3
	93	1	46	53	B	15	48	90	1.4	0.5	0.0	0.9
	92	4	86	10	B	10	32					
Colt Killed Cr.												
	96	-	-	-	N/A	0	0	93	0	0	-	-
	95	-	-	-	N/A	0	0	92	0	0	0	-
	94	-	-	-	N/A	NC	N/A	91	N/A	N/A	0	0
	93	1	46	53	B	2[d]	6.4	90	N/A	0	N/A	0
	92	4	86	10	B	3	9.6					
Big Flat Cr.												
	96	-	-	-	N/A	0	0	93	0	0	-	-
	95	-	-	-	N/A	0	0	92	0	0	0	-
	94	-	-	-	N/A	NC	N/A	91	N/A	N/A	0	0
	93	1	46	53	B	3	9.6	90	N/A	0	N/A	0
	92	4	86	10	B	8	25.6					
Crooked Fork Cr.												
	96	4	64	32	C	76	243.2	93	9.7	9.7	-	-
	95	47	24	29	B	4	12.8	92	161.7	6.0	155.6	-
	94	-	-	-	N/A	0	0	91	80.9	0.0	3.1	77.8
	93	0	20	80	C	10	32	90	3.7	0.0	0.0	3.7
	92	4	86	10	B	11	35.2					
Brushy Fork Cr.												
	96	27	67	6	B	5	16	93	0	0	-	-
	95	47	24	29	B	5	16	92	0	0	0	-
	94	-	-	-	N/A	0	0	91	0	0	0	0
	93	1	46	53	B	25	80	90	0	0	0	0
	92	4	86	10	B	7	22.4					

Appendix E. Continued.

Stream	Return Year	% 1.1	% 1.2	%1.3	Age comp. method[a]	Total number of redds	Estimated Escapement	Total number of adult returns by brood year				
								BY	Total	1.1	1.2	1.3
Salmon River												
Slate Cr.												
	96	-	-	-	N/A	0	0	93	0	0	-	-
	95	29	63	8	B	3	9.6	92	2.8	2.8	0	-
	94	13	20	67	B	1	3.2	91	6.5	0.4	6.0	0
	93	2	33	65	B	1	3.2	90	1.5	0.1	0.6	0.8
	92	7	87	6	B	4	12.8					
S.F. Salmon River[e]												
	96	61.5	35.4	3.1	W	78	249.6	93	153.5	153.5	-	-
	95	32.9	58.3	8.8	W	61	195.2	92	152.6	64.2	88.4	-
	94	0	9	91	C	76	243.2	91	121.5	0.0	113.8	7.7
	93	2	33	65	B	694	2220.8	90	83.5	44.4	21.9	17.2
	92	7	87	6	B	454	1452.8					
Secesh River												
	96	5	61	34	C	42	134.4	93	6.7	6.7	-	-
	95	17	39	44	C	18	57.6	92	91.8	9.8	82.0	-
	94	13	20	67	B	21	67.2	91	76.9	8.7	22.5	45.7
	93	0	27	73	C	91	291.2	90	38.8	0.0	13.4	25.3
	92	0	86	14	C	66	211.2					
Lake Cr.												
	96	0	67	33	C	31	99.2	93	0.0	0.0	-	-
	95	29	63	8	B	12	38.4	92	77.6	11.1	66.5	-
	94	13	20	67	B	12	38.4	91	61.9	5.0	24.2	32.7
	93	2	33	65	B	44	140.8	90	13.6	2.8	7.7	3.1
	92	4	79	17	C	43	137.6					
Johnson Cr.												
	96	20	45	35	C	22	70.4	93	14.1	14.1	-	-
	95	29	63	8	B	5	16	92	36.3	4.6	31.7	-
	94	13	20	67	B	26	83.2	91	45.5	10.8	10.1	24.6
	93	0	11	89	C	170	544	90	17.9	0.0	16.6	1.3
	92	4	67	29	C	60	192					
Marsh Cr.												
	96	52	41	7	B	6	19.2	93	10.0	10.0	-	-
	95	-	-	-	N/A	0	0	92	7.9	0.0	7.9	-
	94	13	20	67	B	9	28.8	91	5.1	3.7	0.0	1.3
	93	0	13	87	W	47	150.4	90	5.8	0.0	5.8	0.0
	92	7	87	6	B	66	211.2					
Bear Valley Cr.												
	96	4	71	25	C	12	38.4	93	1.5	1.5	-	-
	95	29	63	8	B	3	9.6	92	30.0	2.8	27.3	-
	94	13	20	67	B	4	12.8	91	17.3	1.7	6.0	9.6
	93	0	4	96	C	138	441.6	90	3.3	0.0	2.6	0.8
	92	7	87	6	B	26	83.2					

Appendix E. Continued.

Stream	Return Year	% 1.1	% 1.2	%1.3	Age comp. method[a]	Total number of redds	Estimated Escapement	Total number of adult returns by brood year				
								BY	Total	1.1	1.2	1.3
N.F. Salmon River												
	96	52	41	7	B	5	16	93	0	0	-	-
	95	29	63	8	B	1	3.2	92	0	0	0	-
	94	13	20	67	B	3	9.6	91	0	0	0	0
	93	2	33	65	B	17	54.4	90	0	0	0	0
	92	7	87	6	B	12	38.4					
Lemhi River												
	96	52	41	7	B	29	92.8	93	48.3	48.3	-	-
	95	29	63	8	B	9	28.8	92	46.4	8.4	38.0	-
	94	13	20	67	B	20	64	91	33.0	8.3	18.1	6.5
	93	1.8	74.1	24.1	W	37	118.4	90	17.2	2.1	12.8	2.3
	92	7	87	6	B	15	48					
Pahsimeroi River												
	96	11.2	65.2	23.6	W	13	41.6	93	4.7	4.7	-	-
	95	8.8	91.2	0	W	11	35.2	92	30.2	3.1	27.1	-
	94	25.0	72.2	2.8	W	19	60.8	91	57.1	15.2	32.1	9.8
	93	2	33	65	B	63	201.6	90	47.9	4.0	43.9	0.0
	92	7	87	6	B	32	102.4					
E.F. Salmon River												
	96	52	41	7	B	2	6.4	93	3.3	3.3	-	-
	95	-	-	-	N/A	0	0	92	2.6	0.0	2.6	-
	94	13	20	67	B	5	16	91	2.5	2.1	0.0	0.4
	93	6	26	68	C	19	60.8	90	6.8	3.6	3.2	0.0
	92	9	46	45	C	1	3.2					
Herd Cr.												
	96	-	-	-	N/A	0	0	93	0.0	0.0	-	-
	95	-	-	-	N/A	0	0	92	0.0	0.0	0.0	-
	94	13	20	67	B	4	12.8	91	1.7	1.7	0.0	0.0
	93	2	33	65	B	43	137.6	90	5.3	2.8	2.6	0.0
	92	7	87	6	B	3	9.6					
W.F. Yankee Fork Salmon River												
	96	52	41	7	B	7	22.4	93	0	0	-	-
	95	-	-	-	N/A	0	0	92	0	0	0	-
	94	13	20	67	B	9	28.8	91	0	0	0	0
	93	2	33	65	B	14	44.8	90	0	0	0	0
	92	7	87	6	B	6	19.2					
Valley Cr.												
	96	52	41	7	B	1	3.2	93	1.7	1.7	-	-
	95	-	-	-	N/A	0	0	92	1.3	0.0	1.3	-
	94	13	20	67	B	4	12.8	91	1.9	1.7	0.0	0.2
	93	4	10	86	C	73	233.6	90	11.9	9.3	2.6	0.0
	92	7	87	6	B	7	22.4					

Appendix E. Continued.

Stream	Return Year	% 1.1	% 1.2	%1.3	Age comp. method[a]	Total number of redds	Estimated Escapement	Total number of adult returns by brood year BY	Total	1.1	1.2	1.3
Upper Salmon River												
	96	17.3	64.7	18	W	14	44.8	93	7.8	7.8	-	-
	95	-	-	-	N/A	0	0	92	29.0	0.0	29.0	-
	94	13	20	67	B	22	70.4	91	17.2	9.2	0.0	8.1
	93	0	5	95	C	127	406.4	90	14.1	0.0	14.1	0.0
	92	7	87	6	B	27	86.4					

[a] Percent at age composition data were determined with the following methods:

C included only carcasses recovered from the spawning grounds when n > 20.

W When a weir was present on an ISS stream, all fish encountered at the weir were used to determine % age composition if n > 20.

B If an ISS stream had <20 fish at weirs or carcasses recovered for a given year, a basin-wide average age composition was used. The basin-wide age composition for a given year was calculated using all available length and carcass information on ISS streams for a given year. (1995-1996) In calculating the basin-wide age composition, if an ISS stream with a weir also had carcasses collected above it, the carcass data was not used to prevent the same fish from being counted twice. (1992-1994) Most weir data did not distinguish 2-ocean and 3-ocean fish; therefore, age composition for these years could not be determined from hatchery weir data. Furthermore, weir data could not be used in calculating basin-wide age composition estimates (primarily return years 1992 to 1994), because weir data was not available with age breakdowns.

N/A Age composition was not presented when total redds were zero.

[b] 125 pairs of hatchery adults were outplanted in 1993, thus, this is probably an overestimate of natural adult escapement.

[c] 165 pairs of hatchery adults were outplanted in 1993, thus, this is probably an overestimate of natural adult escapement.

[d] 25 male and 15 female hatchery adults were outplanted in 1993, thus, this is probably an overestimate of natural adult escapement.

[e] Escapement estimates do not account for tribal harvest that may have occurred on the South Fork Salmon River.

Appendix F. Table 1. Male chinook salmon adult returns to Idaho weirs, 1991-1996. Ponded fish counts include mortalities if any occurred. Data for Clear Creek from the United States Fish & Wildlife Service; data for Lemhi River from the Idaho Cooperative Fish & Wildlife Research Unit and Idaho Department of Fish & Game (IDFG); data for all other streams from IDFG hatchery evaluation studies (unpublished). Fin clips are as follows: AD = adipose, RV = right ventral, LV = left ventral, UNM = unmarked.

	MALES															
AGE	**3 (Jacks)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Males[a]**
CROOKED R.																
1996																
ponded	68	11	1		80	65	1	2	13	81				1	1	162
released	10	1		1	12	16			15	31					0	43
total	78	12	1	1	92	81	1	2	28	112				1	1	205
1995																
ponded	6				6					0					0	6
released					0					0					0	0
total	6				6					0					0	6
1994																
ponded					0											3
released					0											5
total					0				2	2				6	6	8
1993																
ponded																
released																
total				6	6				45	45				140	140	191
1992																
ponded																
released																
total				13	13				117	117				4	4	134

Appendix F. Table 1. Continued.

AGE	MALES															
	3 (Jacks)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Males[a]
CROOKED R. continued.																
1991																
ponded																
released																
total				2	2				8	8				5	5	15
RED R.																
1996																
ponded	5				5	23	2	1	1	27					0	32
released		2		2	4				12	12					0	16
total	5	2		2	9	23	2	1	13	39					0	48
1995																
ponded	1				1					0					0	1
released	1				1					0					0	1
total	2				2					0					0	2
1994																
ponded					0											8
released					0											10
total				0	0				9	9				9	9	18
1993																
ponded					0											25
released				1	1											49
total				1	1				48	48				25	25	74
1992																
ponded																
released																
total				2	2				20	20				1	1	23

Appendix F. Table 1. Continued.

AGE	MALES															
	3 (Jacks)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Males[a]
RED R. continued.																
1991																
ponded				1	1											7
released				0	0											4
total				1	1				4	4				6	6	11
CLEAR CR.																
1996																
ponded	62				62	22			3	25	2				2	89
released	3	1		2	6	1			1	2						8
total																
Walton Cr.[b]																
1996																
ponded	42	2		1	45	63	2	1		66					0	111
released					0		1		4	5					0	5
total	42	2		1	45	63	3	1	4	71					0	116
1995																
ponded																
released																
total	12				12			1		1					0	13
1994																
ponded			1[c]		1											31
released					0											0
total			1		1				10	10				20	20	31
1993																
ponded																
released																
total				8	8				79	79				171	171	258

Appendix F. Table 1. Continued.

	MALES															
AGE	**3 (Jacks)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Males[a]**
Walton Cr.[b] continued																
1992																
ponded				6	6											109
released				0	0											28
total				6	6				118	118				13	13	137
1991																
ponded				0	0											6
released				7	7											22
total				7	7				13	13				8	8	28
CROOKED FORK CR.																
1994																
released					0											0
total																
S. FORK SALMON R.																
1996																
ponded	526	169		8	703	142		11	20	173	15	3			18	894
released				35	35			25	61	86		1		2	3	124
total	526	169		43	738	142		36	81	259	15	4		2	21	1018
1995																
ponded					91											158
released					10											50
total	76	2	9	14[d]	101	66	12		10	88	8	5		6	19	208
1994																
ponded					69											149
released					3											101
total		10		62	72				31	31				147	147	250

Appendix F. Table 1. Continued.

	MALES															
AGE	3 (Jacks)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Males[a]
S. FORK SALMON R. continued.																
1993																
ponded					21											525
released					7											691
total				28	28				527	527				661	661	1216
1992																
ponded																
released																
total				208	208				1501	1501				19	19	1728
1991																
ponded					650											762
released					171											215
total				821	821				86	86				70	70	977
MARSH CR.																
1994																
released					0											9
total					0											9
1993																
released					0				11	11				54	54	65
total					0				11	11				54	54	65
Lemhi R.																
1994[e]																
released																4
total																4

Appendix F. Table 1. Continued.

	MALES															
AGE	**3 (Jacks)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Males[a]**
Lemhi R. continued.																
1993																
released				1	1				12	12				9	9	22
total				1	1				12	12				9	9	22
1992																
released					2											
total					2											
PAHSIMEROI R.																
1996																
ponded		5			5	11		1		12	3				3	20
released				5	5			2	21	23				10	10	38
total		5		5	10	11		3	21	35	3			10	13	58
1995																
ponded	2				2	15				15					0	17
released			1	4	5			4	7	11					0	16
total	2		1	4	7	15		4	7	26					0	33
1994																
ponded					0					0					0	0
released	6		1	2	9	1			10	11					0	20
total					9					11					0	20
1993																
ponded					4											26
released					9											53
total				13	13				12	12				54	54	79

Appendix F. Table 1. Continued.

AGE	MALES															
	3 (Jacks)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Males[a]
PAHSIMEROI R. continued.																
1992																
ponded																
released																
total				6	6				66	66				6	6	78
1991																
ponded					14											72
released					6											36
total				20	20				61	61				27	27	108
E. FORK SALMON R.																
1996																
ponded					0					0					0	0
released			1	2	3				5	5					0	8
total			1	2	3				5	5					0	8
1995	NO FISH TRAPPED															
1994																
ponded					0											0
released					0											11
total				0	0				2	2				9	9	11
1993																
ponded					0											13
released					5											44
total				5	5				13	13				39	39	57

Appendix F. Table 1. Continued.

AGE	MALES															
	3 (Jacks)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Males[a]
E. FORK SALMON R. continued.																
1992																
ponded																18
released																34
total				10	10				23	23				19	19	52
1991																
ponded					3											11
released					3											34
total				6	6				23	23				16	16	45
Up. Salmon[f]																
1996																
ponded	18			1	19	6[g]		1	19	26	3			4	7	52
released			3	5	8	1		1	46	48	1			9	10	66
total	18		3	6	27	7		2	65	74	4			13	17	118
1995																
ponded	6				6	6				6	3				3	15
released			2	8	10				7	7				1	1	18
total	6		2	8	16	6			7	13	3			1	4	33
1994																
ponded					0											6
released					6											50
total	2			4	6					37					13	56
1993																
ponded					22											93
released					7											214
total					29					44					234	307

Appendix F. Table 1. Continued.

	MALES															
AGE	**3 (Jacks)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Males[a]**
Up. Salmon[f] continued.																
1992																
ponded																133
released																89
total					14					170					38	222
1991																
ponded																155
released																144
total					41					151					107	299

[a] includes jacks
[b] includes 1991 data for Lochsa River weir
[c] must have been a stray, but not from Colt Killed Creek as brood year 1991 fish released there were marked with RV clips
[d] available data did not allow for determination of marks based on age group between ponded and released fish
[e] weir only operated until June 17
[f] upper Salmon River at Sawtooth Hatchery
[g] fin clip disposition for two of these fish not available, assumed to be AD clips

Appendix F. Table 2. Female chinook salmon adult returns to Idaho weirs, 1991-1996. Ponded fish counts include mortalities if any occurred. Data for Clear Creek from the United States Fish & Wildlife Service; data for Lemhi River from the Idaho Cooperative Fish & Wildlife Research Unit and Idaho Department of Fish & Game (IDFG); data for all other streams from IDFG hatchery evaluation studies (unpublished). Fin clips are as follows: AD = adipose, RV = right ventral, LV = left ventral, UNM = unmarked.

	FEMALES															
AGE	**3 (Jills)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
CROOKED R.																
1996																
ponded					0	69			5	74					0	74
released					0	10			10	20					0	20
total					0	79			15	94					0	94
1995																
ponded										0					0	0
released										0					0	0
total										0					0	0
1994																
ponded																12
released																6
total				1	1				13	13				4	4	18
1993																
ponded																136
released																75
total				1	1				44	44				166	166	211
1992																
ponded																3
released																91
total				0	0				91	91				3	3	94

Appendix F. Table 2. Continued.

AGE	FEMALES															
	3 (Jills)					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
CROOKED R. continued.																
1991																
ponded																
released																5
total				0	0				5	5				0	0	5
RED R.																
1996																
ponded					0	12			1	13					0	13
released					0				1	1					0	1
total					0	12			2	14					0	14
1995																
ponded				0	0					0	1				1	1
released				1	1					0	0				0	1
total				1	1					0	1				1	2
1994																
ponded																8
released																5
total				0	0				9	9				4	4	13
1993																
ponded																23
released																42
total				0	0				51	51				14	14	65
1992																
ponded																
released																
total				1	1				13	13				2	2	16

Appendix F. Table 2. Continued.

AGE	FEMALES															
	3 (Jills)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Females
RED R. continued.																
1991																
ponded																4
released																3
total				0	0				5	5				2	2	7
CLEAR CR.																
1996																
ponded						49				49						49
released						11			3	14						14
total																
Walton Cr.[a]																
1996																
ponded						70				70					0	70
released										0					0	0
total				0	0	70				70					0	70
1995																
ponded																
released																
total				0	0				0	0				1	1	1
1994																
ponded																55
released																0
total				0	0				18	18				37	37	55
1993																
ponded																
released																
total				0	0				100	100				142	142	242

Appendix F. Table 2. Continued.

	FEMALES															
AGE	**3 (Jills)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
Walton Cr.[a] continued.																
1992																
ponded																133
released																0
total				0	0				131	131				2	2	133
1991																
ponded																2
released																3
total				0	0				3	3				2	2	5
CROOKED FORK CR.																
1994																
released																0
total																
S. FORK SALMON R.																
1996																
ponded						94		8	12	114	14	2			16	130
released								32	19	51					0	51
total						94		40	31	165	14	2			16	181
1995																
ponded																64
released																35
Total						72	12		7	91	3	2		3	8	99
1994																
ponded																173
released																104
Total				0	0				13	13				264	264	277

Appendix F. Table 2. Continued.

	FEMALES															
AGE	**3 (Jills)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
S. FORK SALMON R. continued.																
1993																
ponded																597
released																890
total				0	0				555	555				932	932	1487
1992																
ponded																
released																
total				1	1				1113	1113				6	6	1120
1991																
ponded																162
released																73
total				0	0				34	34				201	201	235
MARSH CR.																
1994																
released																7
total																7
1993																
released									3	3				40	40	43
total									3	3				40	40	43
Lemhi R.																
1994[b]																
released																0
total																0

Appendix F. Table 2. Continued.

AGE	FEMALES															
	3 (Jills)					4					5					Total
FIN CLIP	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	AD	RV	LV	UNM	Total	Females
Lemhi R. continued.																
1993																
released									28	28				4	4	32
total									28	28				4	4	32
1992[c]																
released																
total																
PAHSIMEROI R.																
1996																
ponded					0	12		1		13	4		1		5	18
released					0				10	10				3	3	13
total					0	12		1	10	23	4		1	3	8	31
1995																
ponded					0	36				36					0	36
released					0			7	4	11					0	11
total					0	36		7	4	47					0	47
1994																
ponded										0					0	0
released									15	15				1	1	16
total					0				15	15				1	1	16
1993																
ponded																29
released																61
total				0	0				25	25				65	65	90

Appendix F. Table 2. Continued.

	FEMALES															
AGE	**3 (Jills)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
PAHSIMEROI R. continued.																
1992																
ponded																
released																
total				0	0				32	32				21	21	53
1991																
ponded																90
released																40
total				0	0				78	78				52	52	130
E. FORK SALMON R.																
1996																
ponded										0					0	0
released									2	2					0	2
total									2	2					0	2
1995																
1994																
ponded																0
released																4
total				0	0				0	0				4	4	4
1993																
ponded																12
released																21
total				1	1				6	6				26	26	33

Appendix F. Table 2. Continued.

	FEMALES															
AGE	**3 (Jills)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
E. FORK SALMON R. continued.																
1992																
ponded																7
released																6
total				1	1				5	5				7	7	13
1991																
ponded																8
released																9
total				0	0				0	0				17	17	17
Up. Salmon[d]																
1996																
ponded						2			3	5	2			3	5	10
released						11		1	10	22		1		5	6	28
total						13		1	13	27	2	1		8	11	38
1995																
ponded						1				1			1		1	2
released									1	1				1	1	2
total						1			1	2			1	1	2	4
1994																
ponded																7
released																33
total										27					13	40
1993																
ponded																71
released																209
total										33					247	280

Appendix F. Table 2. Continued.

	FEMALES															
AGE	**3 (Jills)**					**4**					**5**					**Total**
FIN CLIP	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**AD**	**RV**	**LV**	**UNM**	**Total**	**Females**
Up. Salmon[d] continued.																
1992																
ponded																109
released																56
total					1					93					71	165
1991																
ponded																173
released																94
total										48					219	267

[a] includes 1991 data for Lochsa River weir
[b] weir only operated until June 17
[c] sex not determined for adults
[d] upper Salmon River at Sawtooth Hatchery

Appendix F. Table 3. Number of Chinook Salmon of unknown sex and grand total returns of all chinook salmon (males + females + unknown sex) returning to Idaho weirs, 1991-1996. Ponded fish counts include mortalities if any occurred. Data for Clear Creek from the United States Fish & Wildlife Service; data for Lemhi River from the Idaho Cooperative Fish & Wildlife Research Unit and Idaho Department of Fish & Game (IDFG); data for all other streams from IDFG hatchery evaluation studies (unpublished). UNK = age unknown.

	UNKNOWN SEX					
AGE	**3**	**4**	**5**	**UNK**	**Total Unknowns**	**Grand Total**
CROOKED R.						
1996						
ponded						236
released						63
total						299
1995						
ponded						6
released						0
total						6
1994						
ponded						15[a]
released						11
total						26
1993						
ponded						250
released						152
total						402
1992						
ponded						12
released						216
total						228
1991						
ponded						1
released						19
total						20
RED R.						
1996						
ponded						45
released						17
Total						62

Appendix F. Table 3. Continued.

AGE	UNKNOWN SEX 3	4	5	UNK	Total Unknowns	Grand Total
RED R. continued.						
1995						
ponded						2
released						2
total						4
1994						
ponded						16[b]
released						15
total						31
1993						
ponded						48
released						91
total						139
1992						
ponded						15
released						24
total						39
1991						
ponded						11
released						7
total						18
CLEAR CR.						
1996						
ponded	23	9			32	170
released		10			10	32
total						
1995						
ponded	19	7	12		38	38
released						
total						
1994						
ponded	1	88	118		207	207
released		8	17		25	25
total						
1993						
ponded	10	689	390		1089	1089
released	1	67	23		91	91
total						

Appendix F. Table 3. Continued.

AGE	UNKNOWN SEX 3	4	5	UNK	Total Unknowns	Grand Total
CLEAR CR. continued.						
1992						
ponded	14	239	38	21	312	312
released						
total						
1991						
ponded	10	98	350	9	467	467
released						
total						
Walton Cr.[c]						
1996						
ponded						181
released						5
total						186
1995						
ponded						9
released						5
total						14
1994						
ponded						86
released						0
total						86
1993						
ponded						500
released						0
total						500
1992						
ponded						242
released						28
total						270
1991						
ponded						8
released						25
total						33
CROOKED FORK CR.						
1994						
released						0
total						

Appendix F. Table 3. Continued.

AGE	UNKNOWN SEX 3	4	5	UNK	Total Unknowns	Grand Total
S. FORK SALMON R.						
1996						
ponded						1024
released						175
total						1199
1995						
ponded						222
released						85
total						307
1994						
ponded						322
released						205
total						527
1993						
ponded						1122
released						1581
total						2703
1992						
ponded						1017
released						1831
total						2848
1991						
ponded						924
released						288
total						1212
MARSH CR.						
1994						
released						16
total						16
1993						
released						108
total						108
Lemhi R.						
1994[d]						
released						4
total						4

Appendix F. Table 3. Continued.

AGE	UNKNOWN SEX 3	4	5	UNK	Total Unknowns	Grand Total
Lemhi R. continued.						
1993						
released						54
total						54
1992[e]						
released						32
total						32
PAHSIMEROI R.						
1996						
ponded						38
released						51
total						89
1995						
ponded						53
released						27
total						80
1994						
ponded						0
released						36
total						36
1993						
ponded						55
released						114
total						169
1992						
ponded						86
released						45
total						131
1991						
ponded						162
released						76
total						238
E. FORK SALMON R.						
1996						
ponded						0
released						10
total						10

Appendix F. Table 3. Continued.

AGE	UNKNOWN SEX 3	4	5	UNK	Total Unknowns	Grand Total
E. FORK SALMON R. continued.						
1995						0
1994						
ponded						0
released						15
total						15
1993						
ponded						25
released						65
total						90
1992						
ponded						25
released						40
total						65
1991						
ponded						19
released						43
total						62
Up. Salmon[f]						
1996						
ponded						62
released						94
total						156
1995						
ponded						17
released						20
total						37
1994						
ponded						13[g]
released						83
total						96
1993						
ponded						164
released						423
total						587

Appendix F. Table 3. Continued.

AGE	UNKNOWN SEX 3	4	5	UNK	Total Unknowns	Grand Total
Up. Salmon[f] continued.						
1992						
ponded						242
released						145
total						387
1991						
ponded						328
released						238
total						566

[a] 7 fish with LV marks were trapped this season
[b] 3 fish with LV marks were trapped this season
[c] includes 1991 data for Lochsa River weir
[d] weir only operated until June 17
[e] sex not determined for adults
[f] upper Salmon River at Sawtooth Hatchery
[g] some LV marked fish were reported caught, but their number and distribution cannot be determined from the available data

Appendix G. Summary of chinook salmon redds counted and redds per kilometer for Idaho Supplementation Studies streams, 1992-1996.

Stream	Year	Stream Length Sampled (km)	Number of Redds Counted	Number of Redds per kilometer
Clearwater River Basin				
Lolo Creek	1996	16.7	21	1.26
	1995	16.7	6	0.35
	1994	16.7	7	0.42
	1993	16.7	23	1.38
	1992	16.7	19	1.14
Eldorado Creek	1996	3.5	0	0.00
	1995	3.5	0	0.00
	1994	3.5	0	0.00
	1993	3.5	2	0.28
	1992	3.5	0	0.00
Yoosa Creek	1996	4.4	0	0.00
	1995	4.4	0	0.00
	1994	4.4	0	0.00
	1993	4.4	1	0.57
	1992	4.4	0	0.00
Newsome Creek	1996	15.1	4	0.26
	1995	15.1	0	0.00
	1994	15.1	0	0.00
	1993	15.1	55[a]	3.64
	1992	15.1	2	0.13
Crooked River	1996	33.1	4[b]	0.18
	1995	33.1	0	0.00
	1994	33.1	4	0.12
	1993	33.1	54	1.63
	1992	33.1	54	1.63
	1991	33.1	4	0.12
American River	1996	34.6	9	0.26
	1995	34.6	0	0.00
	1994	34.6	9	0.26
	1993	34.6	209[c]	6.04
	1992	33.3	5	0.15
Red River	1996	34.1	41	1.20
	1995	43.0	17	0.40
	1994	43.0	23	0.53
	1993	38.5	69	1.79
	1992	43.0	44	1.02
	1991	23.6	6	0.25
Clear Creek	1996	16.1	3	0.19
	1995	16.1	0	0.00
	1994	16.1	1	0.06
	1993	16.1	7	0.43
	1992	16.1	1	0.06

Appendix G. Continued.

Stream	Year	Stream Length Sampled (km)	Number of Redds Counted	Number of Redds per kilometer
Clear Creek	1991	16.1	4	0.25
White Cap Creek	1996	19.8	3	0.15
	1995	19.8	0	0.00
	1994	19.8	2	0.10
	1993	19.8	6	0.30
	1992	19.8	2	0.10
Pete King Creek	1996	8.0	0	0.00
	1995	8.0	0	0.00
	1994	8.0	0	0.00
	1993	8.0	0	0.00
	1992	8.0	0	0.00
	1991	8.0	0	0.00
Squaw Creek	1996	6	1	0.17
	1995	6	0	0.00
	1994	6	0	0.00
	1993	6	0	0.00
	1992	6	1	0.17
Papoose Creek	1996	3	7	2.33
	1995	3	1	0.33
	1994	3	0	0.00
	1993	3	15	5.00
	1992	3	10	3.33
Colt Killed Creek	1996	6.8	0	0.00
	1995	2.6	0	0.00
	1994	NC[d]	NC	NC
	1993	7	2	0.29
	1992	11.5	3	0.26
Big Flat Creek	1996	1.5	0	0.00
	1995	5.8	0	0.00
	1994	NC	NC	NC
	1993	6	3	0.50
	1992	8	8	1.00
Crooked Fork Creek	1996	21.5	76[e]	3.53
	1995	19	4	0.21
	1994[f]	21.5	0	0.00
	1993	28	10[g]	0.36
	1992	29.5	11[b]	0.37
Brushy Fork and Spruce Creek				
	1996	21.5	5	0.23
	1995	14	5	0.36
	1994	21.5	0[h]	0.00
	1993	18.1	25	1.38
	1992	14	7	0.50

Appendix G. Continued.

Stream	Year	Stream Length Sampled (km)	Number of Redds Counted	Number of Redds per kilometer
Salmon River Drainage				
Slate Creek				
	1996	5.5	0	0.00
	1995	5.5	3	0.54
	1994	5.5	1	0.18
	1993	5.5	1	0.18
	1992	5.5	4	0.72
	1991	5.5	6	1.08
South Fork Salmon River				
	1996	29.2	78	2.67
	1995	29.2	61	2.09
	1994	29.2	76	2.60
	1993	29.2	694	23.77
	1992	29.2	454	15.55
Secesh River				
	1996	10.3	42	4.08
	1995	10.3	18	1.75
	1994	10.3	21	2.04
	1993	10.3	91	8.83
	1992	10.3	66	6.41
	1991	10.3	62	6.02
Lake Creek				
	1996	13.6	31	2.28
	1995	13.6	12	0.88
	1994	13.6	12	0.88
	1993	13.6	44	3.24
	1992	13.6	43	3.16
	1991	13.6	34	2.50
Johnson Creek[l]				
	1996	31	22	0.71
	1995	31	5	0.16
	1994	31	26	0.84
	1993	20.8	170[j]	8.17
	1992	20.8	60	2.88
	1991	20.8	69	3.32
Marsh Creek[k]				
	1996	11.0	6	0.55
	1995	11.0	0	0.00
	1994	11.0	9	0.82
	1993	11.0	45[b]	4.09
	1992[l]	9.8	66	6.73
Bear Valley Creek				
	1996	35.7	12	0.34
	1995	35.7	3	0.08
	1994	35.7	4	0.11
	1993	35.7	138	3.86
	1992	35.7	26	0.73

Appendix G. Continued.

Stream	Year	Stream Length Sampled (km)	Number of Redds Counted	Number of Redds per kilometer
North Fork Salmon River				
	1996	36.8	5	0.14
	1995	36.8	1	0.03
	1994	36.8	3	0.08
	1993	36.8	17	0.46
	1992	36.8	12	0.33
	1991	36.8	8	0.22
Lemhi River				
	1996	51.7	29	0.56
	1995	51.7	9	0.17
	1994	51.7	20	0.39
	1993	51.7	37	0.72
	1992	51.7	15[m]	0.29
Pahsimeroi River				
	1996	14.5	13	0.90
	1995	15.5	11	0.71
	1994[f]	16.5	19	1.15
	1993	23.0	63	2.74
	1992	26.5	32	1.21
East Fork Salmon River				
	1996	27.0	2	0.07
	1995	27.0	0	0.00
	1994	27.0	5	0.18
	1993	27.0	19	0.70
	1992	27.0	1	0.04
Herd Creek				
	1996	17.1	0	0.00
	1995	17.1	0	0.00
	1994	17.1	4	0.23
	1993	17.1	43	2.51
	1992	14.1	3	0.21
West Fork Yankee Fork Salmon River				
	1996	11.6	7	0.60
	1995	11.6	0	0.00
	1994	11.6	9	0.78
	1993	11.6	14	1.21
	1992	11.6	6	0.52
Valley Creek				
	1996	48.7	1	0.02
	1995	48.7	0	0.00
	1994	43.7	4	0.09
	1993	52.3	73	1.40
	1992	33.2	7	0.21

Appendix G. Continued.

Stream	Year	Stream Length Sampled (km)	Number of Redds Counted	Number of Redds per kilometer
Upper Salmon River				
	1996	59.0	14	0.24
	1995	59.0	0	0.00
	1994	59.0	22	0.37
	1993	59.0	127	2.15
	1992	59.0	27	0.46

[a] 125 adult pairs were outplanted from Rapid River Hatchery
[b] two additional redds occurred below the juvenile trap
[c] 150 adult pairs were outplanted from Rapid River Hatchery
[d] NC = No count (stream was not surveyed)
[e] Six additional redds occurred below the juvenile trap
[f] Distance reported is for the IDFG trend area; number of redds is from Nemeth et al. (1996)
[g] three additional redds occurred below the juvenile trap
[h] A single adult chinook salmon was seen in Brushy Fork Creek during snorkeling activities
[i] Moose Creek to Burnt Log Creek section (6.2 km) not surveyed 1991-1993; from 1994-1996, Burnt Log Creek, from the mouth to 2.0 km above Buck Creek (4.0 km total), was included in the count
[j] This number is conservative as one section of stream, Moose Creek to Burnt Log trail crossing, was not counted, but was known to have redds
[k] Includes Knapp Creek
[l] Section from Knapp Cr. to Dry Cr. was not surveyed in 1992
[m] Aerial count

Appendix H. Number of chinook salmon carcasses sampled during spawning ground surveys on Idaho Supplementation Studies streams, Clearwater and Salmon River basins, return years 1991 through 1996. Age determination was by fork length frequency (1.1 < 640mm; 1.2 640 - 789mm; 1.3 > 790mm), or by scales when fork lengths were not available. Fin clip: NO = no fin clip, AD = adipose, RV = right ventral, LV = left ventral, UNK = unknown if any fin clips.

				Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
Basin/Stream	**RY**	**No.**	**Fin Clip**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
CLEARWATER																					
Lolo/Yoosa Creek	1996	2	NO									2	100	2	100						
	1995	2	NO									1	50	1	50			1	50	1	50
	1994	2	NO							1	50	1	50	2	100						
	1993	11	NO							2	18	3	27	5	45	3	27	3	27	6	55
	1992	3	NO									1	33	1	33			2	67	2	67
	Totals	20								3	15	8	40	11	55	3	15	6	30	9	45
Eldorado Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	0																			
	1992	0																			
	Totals	0																			
CLEARWATER (South Fork)																					
Newsome Creek	1996	2	AD									2	100	2	100						
	1996	1	RV	1	100			1	100												
	1995	0																			
	1994	0																			
	1993	37	NO							4	11	10	27	14	38	13	35	10	27	23	62
	1993	2	LV	1	50			1	50	1	50			1	50						
	1992	0																			
	Totals	42		2	4.8			2	4.8	5	12	12	29	17	40	13	31	10	24	23	55
Crooked River	1996	4	NO							2	50	1	25	3	75			1	25	1	25
	1995	0																			
	1994[a]	13	NO									6	46	6	46	3	23	4	31	7	54
	1994	9	NO							2	22	1	11	3	33	1	11	5	56	6	67

Appendix H. Continued.

				Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
Basin/Stream	**RY**	**No.**	**Fin Clip**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Crooked River	1993	0																			
	1992	0																			
	Totals	26								4	15	8	31	12	46	4	15	10	38	14	54
American River	1996	0																			
	1995	0																			
	1994	1																1	100	1	100
	1993	79								10	13	14	18	24	30	36	46	19	24	55	70
	1992	0																			
	Totals	80								10	13	14	18	24	30	36	45	20	25	56	70
Red River	1996	9	NO							3	33	5	56	8	89	1	11			1	11
	1996	7	AD	1	14			1	14	1	14	3	43	4	57	1	14	1	14	2	29
	1995	2	NO									1	50	1	50			1	50	1	50
	1995	1	AD	1	100			1	100												
	1994	11	NO			4	36	4	36	2	18	5	45	7	64						
	1994	1	AD									1	100	1	100						
	1993	28	NO							1	3.6	6	21	7	25	10	36	11	39	21	75
	1992	22	NO			1	4.5	1	4.5	12	55	9	41	21	95						
	Totals	81		2	2.5	5	6.2	7	8.6	19	23	30	37	49	60	12	15	13	16	25	31
(Middle Fork) Clear Creek	1996	10	NO							6	60	4	40	10	100						
	1995	0																			
	1994	2	UNK									1	50	1	50			1	50	1	50
	1993	1	NO									1	100	1	100						
	1993	1	UNK													1	100			1	100
	1993	2	AD													1	50	1	50	2	100
	1992	0																			
	Totals	16								6	38	6	38	12	75	2	13	2	13	4	25

Appendix H. Continued.

				Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
Basin/Stream	**RY**	**No.**	**Fin Clip**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
(Middle Fork - Lochsa River)																					
Pete King Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	0																			
	1992	0																			
	Totals	0																			
Squaw Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	1	UNK													1	100			1	100
	1992	0																			
	Totals	1														1	100			1	100
Papoose Creek	1996	1	RV													1	100			1	100
	1995	1	AD															1	100	1	100
	1994	0																			
	1993	3	NO									1	33	1	33	1	33	1	33	2	67
	1992	0																			
	Totals	5										1	20	1	20	2	40	2	40	4	80
Colt Killed Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	0																			
	1992	0																			
	Totals	0																			
Big Flat Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	0																			

Appendix H. Continued.

Basin/Stream	RY	No.	Fin Clip	Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
				n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Big Flat Creek	1992	0																			
	Totals	0																			
Crooked Fork Creek	1996	19	NO			1	5.3	1	5.3	5	26	6	32	11	58	5	26	2	11	7	37
	1996	47	AD	2	4.3			2	4.3	4	8.5	26	55	30	64	11	23	4	8.5	15	32
	1996	5	LV							2	40	2	40	4	80	1	20			1	20
	1995	0																			
	1995	0																			
	1994	0																			
	1993	20	NO							1	5	3	15	4	20	9	45	7	35	16	80
	1992	0																			
	Totals	91		2	2.2	1	1.1	3	3.3	12	13	37	41	49	54	26	29	13	14	39	43
(Middle Fork - Lochsa River- Crooked Fork Creek)																					
Brushy Fork Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	15	NO									3	20	3	20	5	33	7	47	12	80
	1992	0																			
	Totals	15										3	20	3	20	5	33	7	47	12	80
SALMON																					
Slate Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	1	NO									1	100	1	100						
	1992	0																			
	Totals	1										1	100	1	100						

Appendix H. Continued.

				Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
Basin/Stream	**RY**	**No.**	**Fin Clip**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
South Fork Salmon River	1996	62	NO	9	15			9	15	18	29	15	24	33	53	15	24	5	8.1	20	32
	1996	12	AD	4	33			4	33	5	42	1	8.3	6	50	1	8.3	1	8.3	2	17
	1996	17	LV	2	12			2	12	5	29	7	41	12	71	1	5.9	2	12	3	18
	1996	3	RV	1	33			1	33							1	33	1	33	2	67
	1995	10	NO	2	20			2	20	1	10	2	20	3	30	4	40	1	10	5	50
	1995	54	AD	3	5.6			3	5.6	6	11	15	28	21	39	14	26	16	30	30	56
	1995	2	LV	2	100			2	100												
	1995	11	RV							3	27	2	18	5	45	2	18	4	36	6	55
	1994	182	NO							12	6.6	4	2.2	16	8.8	69	38	97	53	166	91
	1993	0																			
	1992	4	NO									2	50	2	50	1	25	1	25	2	50
	Totals	357		23	6.4			23	6.4	50	14	48	13	98	27	108	30	128	36	236	66
Secesh River	1996	43	NO	1	2.3	1	2.3	2	4.7	17	40	9	21	26	60	8	19	7	16	15	35
	1996	1	AD							1	100			1	100						
	1995	23	NO	4	17			4	17	5	22	4	17	9	39	6	26	4	17	10	43
	1994	9	NO							2	22	3	33	5	56	1	11	3	33	4	44
	1994	1	AD															1	100	1	100
	1993	66	NO							12	18	6	9.1	18	27	16	24	32	48	48	73
	1992	57	NO							34	60	15	26	49	86	5	8.8	3	5.3	8	14
	Totals	200		5	2.5	1	0.5	6	3	71	36	37	19	108	54	36	18	50	25	86	43
Lake Creek	1996	24	NO							6	25	10	42	16	67	2	8.3	6	25	8	33
	1995	3	NO							1	33	2	67	3	100						
	1994	3	NO			1	33	1	33			2	67	2	67						
	1993	13	NO							1	7.7			1	7.7	6	46	6	46	12	92
	1992	24	NO			1	4.2	1	4.2	9	38	10	42	19	79	3	13	1	4.2	4	17
	Totals	67				2	3	2	3	17	25	24	36	41	61	11	16	13	19	24	36

Appendix H. Continued.

Basin/Stream	RY	No.	Fin Clip	Age Group 1.1 Male n	%	Female n	%	Total n	%	1.2 Male n	%	Female n	%	Total n	%	1.3 Male n	%	Female n	%	Total n	%
(South Fork Salmon River - East Fork South Fork Salmon River)																					
Johnson Creek	1996	19	NO	3	16	1	5.3	4	21	2	11	6	32	8	42	2	11	5	26	7	37
	1996	1	AD							1	100			1	100						
	1995	2	NO									1	50	1	50			1	50	1	50
	1994	6	NO									2	33	2	33			4	67	4	67
	1993	162	NO							7	4.3	11	6.8	18	11	59	36	85	52	144	89
	1993	3	AD													1	33	2	67	3	100
	1992	90	NO	4	4.4			4	4.4	47	52	13	14	60	67	16	18	10	11	26	29
	Totals	283		7	2.5	1	0.4	8	2.8	57	20	33	12	90	32	78	28	107	38	185	65
Marsh Creek	1996	4	NO													2	50	2	50	4	100
	1995	0																			
	1994	5	NO							3	60			3	60	1	20	1	20	2	40
	1993	91	NO	1	1.1			1	1.1	4	4.4	5	5.5	9	9.9	42	46	39	43	81	89
	1992	0																			
	Totals	100		1	1			1	1	7	7	5	5	12	12	45	45	42	42	87	87
(Middle Fork Salmon River)																					
Bear Valley Creek	1996	28	NO	1	3.6			1	3.6	9	32	11	39	20	71	4	14	3	11	7	25
	1995	1	NO															1	100	1	100
	1994	8	NO									1	13	1	13	3	38	4	50	7	88
	1993	68	NO							1	1.5	2	2.9	3	4.4	24	35	41	60	65	96
	1992	18	NO	1	5.6			1	5.6	6	33	2	11	8	44	1	5.6	8	44	9	50
	Totals	123		2	1.6			2	1.6	16	13	16	13	32	26	32	26	57	46	89	72
North Fork Salmon River	1996	0																			
	1995	0																			
	1994	0																			

Appendix H. Continued.

				Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
Basin/Stream	**RY**	**No.**	**Fin Clip**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
North Fork Salmon River	1993	2	NO									1	50	1	50			1	50	1	50
	1992	4	NO									2	50	2	50			2	50	2	50
	Totals	6										3	50	3	50			3	50	3	50
Lemhi River	1996	0																			
	1995	1	NO							1	100			1	100						
	1994	0																			
	1993	0																			
	1992	0																			
	Totals	1								1	100			1	100						
Pahsimeroi River	1996	0																			
	1995	0																			
	1994	0																			
	1993	3	NO	1	33											1	33	1	33	2	67
	1992	0																			
	Totals	3		1	33											1	33	1	33	2	67
East Fork Salmon River	1996	0																			
	1995	0																			
	1994	15	NO							2	13			2	13	9	60	4	27	13	87
	1993	68	NO	3	4.4	1	1.5	4	5.9	14	21	4	5.9	18	26	18	26	28	41	46	68
	1992	57	NO	4	7	1	1.8	5	8.8	21	37	5	8.8	26	46	19	33	7	12	26	46
	Totals	140		7	5	2	1.4	9	6.4	37	26	9	6.4	46	33	46	33	39	28	85	61
Herd Creek	1996	0																			
	1995	0																			
	1994	0																			
	1993	12	NO													4	33	8	67	12	100
	1993	1	AD	1	100			1	100												
	1992	0																			
	Totals	13		1	7.7			1	7.7							4	31	8	62	12	92

Appendix H. Continued.

				Age Group																	
				1.1						1.2						1.3					
				Male		Female		Total		Male		Female		Total		Male		Female		Total	
Basin/Stream	**RY**	**No.**	**Fin Clip**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
West Fork Yankee Fork	1996	0																			
	1995	0																			
	1994	1	NO															1	100	1	100
	1993	0																			
	1992	0																			
	Totals	1																1	100	1	100
Valley Creek	1996	1	NO									1	100	1	100						
	1995	0																			
	1994	2	NO													1	50	1	50	2	100
	1993	51	NO	2	3.9			2	3.9	4	7.8	1	2	5	9.8	16	31	28	55	44	86
	1992	11	NO							3	27	3	27	6	55			5	45	5	45
	Totals	65		2	3.1			2	3.1	7	11	5	7.7	12	18	17	26	34	52	51	78
Upper Salmon River and Alturas Lake Creek	1996	0																			
	1995	0																			
	1994	1	UNK															1	100	1	100
	1993	43	UNK									2	4.7	2	4.7	18	42	23	53	41	95
	1992	2	UNK			1	50	1	50			1	50	1	50						
	Totals	46				1	2.2	1	2.2			3	6.5	3	6.5	18	39	24	52	42	91

[a] Data from IDFG scale age estimates

Appendix I. Detections of PIT-tagged chinook salmon for brood years 1991 to 1994 from the Clearwater and Salmon River drainages. Numbers in the "First Detections at Main Observation Sites" column represent estimates of minimum survival rates to Lower Granite Dam. Passage dates of 10%, 50%, and 90% represent percentages of the total number of detections at Lower Granite Dam. Main observation sites were facilities at Lower Granite, Little Goose, Lower Monumental, and McNary dams.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Clearwater River Basin								
Lolo Creek								
1994	parr	N	97	0	0	---	---	---
1994	presmolt	N	25	12.0	20.0	4/20/96	5/06/96	5/16/96
1994	smolt	N	62	21.0	41.9	4/08/96	5/27/96	6/07/96
1993	presmolt	N	1652	11.5	18.9	4/13/95	4/28/95	5/29/95
1993	smolt	N	647	32.9	62.6	5/07/95	5/27/95	6/10/95
1992	parr	N	61	6.6	14.8	4/02/94	4/22/94	5/04/94
1992	presmolt	N	1453	14.6	23.9	4/21/94	4/25/94	5/08/94
1992	smolt	N	545	25.3	54.1	4/23/94	5/04/94	5/31/94
1991	parr	N	182	8.8	17.0	4/30/93	5/04/93	5/30/93
1991	presmolt	N	765	14.2	26.5	4/24/93	5/04/93	5/29/93
1991	smolt	N	122	38.5	69.7	5/23/93	6/01/93	6/20/93
Newsome Creek								
1993	parr	N	53	5.7	9.4	5/15/95	5/16/95	5/28/95
1993	presmolt	N	794	5.9	10.2	4/20/95	5/10/95	6/07/95
1993	smolt	H	1200	35.0	58.8	4/25/95	4/30/95	5/07/95
1992	presmolt	N	60	5.0	11.7	4/29/94	5/15/94	7/14/94
Crooked River								
1994	smolt	N	157	16.6	30.6	5/16/96	6/10/96	7/14/96
1994	presmolt	N	34	2.9	8.8	--	--	--
1994	parr	N	514	6.0	8.8	5/14/96	6/10/96	7/02/96
1993	smolt	N	2,061	27.0	43.6	5/27/95	7/01/95	7/19/95
1993	presmolt	N	1,172	5.7	10.2	4/25/95	5/20/95	7/08/95
1993	presmolt	H	1,000	9.20	15.9	4/26/95	5/17/95	6/23/95
1993	parr	N	2,246	9.4	17.1	5/13/95	6/16/95	7/09/95

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Crooked River Continued.								
1992	smolt	N	1,649	14.5	27.4	5/09/94	6/24/94	7/29/94
1992	presmolt	N	357	11.8	22.7	4/22/94	4/25/94	5/17/94
1992	parr	N	1,990	6.1	10.4	4/23/94	5/10/94	7/10/94
1991	smolt	N	88	26.1	53.4	5/15/93	5/31/93	6/21/93
1991	presmolt	N	84	9.5	19.0	4/28/93	5/17/93	6/17/93
1991	parr	N	379	4.0	7.4	5/12/93	5/27/93	6/26/93
American River								
1993	parr	N	696	6.0	9.2	6/28/95	6/02/95	6/30/95
1993	smolt	H	1199	24.5	42.9	4/25/95	4/30/95	5/9/95
Red River								
1994	smolt	N	152	25.7	42.8	4/22/96	5/19/96	6/09/96
1994	presmolt	N	553	10.1	21.5	4/19/96	4/25/96	5/19/96
1993	smolt	N	1,276	26.5	45.5	5/13/95	6/16/95	7/06/95
1993	presmolt	N	1,543	7.7	12.6	4/16/95	5/03/95	6/09/95
1993	presmolt	H	1,000	6.0	10.6	4/21/95	5/22/95	6/15/95
1993	parr	N	650	5.5	9.5	4/17/95	5/14/95	6/16/95
1992	smolt	N	396	14.4	29.0	4/27/94	6/07/94	7/15/94
1992	presmolt	N	1,000	13.7	22.1	4/22/94	4/26/94	5/27/94
1992	presmolt	H	300[b]	7.0	14.7	5/01/94	5/25/94	6/07/94
1992	presmolt	H	700[c]	1.4	3.4	4/22/94	4/25/94	5/20/94
1991	smolt	N	579	21.2	44.0	5/13/93	5/29/93	6/22/93
1991	presmolt	N	264	7.2	12.6	4/26/93	5/06/93	6/05/93
1991	parr	N	294	5.4	10.5	5/20/93	5/29/93	6/13/93
1991	presmolt	H	954	2.6	4.7	4/29/93	5/31/93	6/14/93
Clear Creek								
1994	smolt	N	54	33.3	51.9	4/17/96	4/22/96	5/13/96
1994	smolt	H	503	14.9	35.4	4/28/96	5/8/96	5/15/96
1994	presmolt	N	6	0.0	0.0	--	--	--
1993	presmolt	N	432	10.2	20.9	4/13/95	4/24/95	5/04/95
1993	smolt	H	494	20.1	42.5	4/30/95	5/11/95	5/29/95

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Clear Creek continued.								
1992	smolt	N	1	0.0	100	--	--	--
1992	presmolt	N	298	15.4	25.8	4/01/94	4/23/94	4/29/94
1991	presmolt	N	128	8.6	11.7	4/24/93	4/30/93	5/13/93
1991	parr	N	240	8.8	12.2	4/20/93	4/30/93	5/13/93
Pete King Creek								
1993	parr	H	998	4.11	7.5	4/20/95	5/10/95	6/05/95
1992	parr	H	1,000	6.10	10.0	4/25/94	5/04/94	5/16/94
Squaw Creek								
1993	parr	H	1001	3.1	4.6	4/23/95	5/12/95	6/09/95
1992	parr	H	998	1.3	2.2	4/25/94	5/11/94	7/13/94
1991	parr	H	699	1.9	3.4	5/08/93	5/15/93	6/05/93
Papoose Creek								
1993	presmolt	N	290	5.2	9.3	5/07/95	6/01/95	6/18/95
1993	smolt	H	499	24.6	41.9	4/21/95	4/29/95	5/08/95
1992	smolt	H	499	26.3	43.7	4/27/94	5/08/94	5/12/94
Colt Killed (White Sand) Creek								
1993	parr	H	998	2.30	4.0	4/18/95	5/10/95	6/03/95
1992	parr	H	1,000	2.80	5.4	4/26/94	5/07/94	8/10/94
1991	parr	H	1,399	0.64	1.7	5/09/93	5/20/93	6/23/93
Big Flat Creek								
1993	parr	H	997	4.31	7.3	4/12/95	4/29/95	5/30/95
1992	parr	H	1,000	3.00	5.4	4/23/94	5/01/94	5/09/94
Crooked Fork Creek								
1994	smolt	N	11	18.2	45.5	--	--	--
1994	presmolt	N	368	9.5	22.8	4/16/96	4/25/96	5/08/96
1993	smolt	N	162	23.0	40.4	5/09/95	6/14/95	7/08/95
1993	presmolt	N	2,699	10.0	17.5	4/19/95	5/09/95	6/08/95

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Crooked Fork Creek continued.								
1993	parr	N	192	5.2	9.9	4/22/95	5/14/95	6/03/95
1992	smolt	N	342	13.2	25.1	5/04/94	6/23/94	8/05/94
1992	presmolt	N	1,861	11.6	19.1	4/25/94	5/08/94	7/08/94
1992	parr	N	223	4.5	8.5	4/24/94	5/11/94	7/15/94
1991	smolt	N	303	24.8	48.2	5/09/93	5/21/93	6/21/93
1991	presmolt	N	859	14.0	25.4	4/29/93	5/11/93	5/26/93
1991	presmolt	H	88[d]	9.1	22.7	4/25/93	5/09/93	6/09/93
Brushy Fork Creek								
1993	parr	N	126	2.4	4.0	4/24/95	5/22/95	6/7/95
1992	parr	N	154	0.6	0.6	--	--	--
1991	parr	N	230	5.7	9.1	5/07/93	6/10/93	6/29/93
Salmon River Basin								
South Fork Salmon River								
1994	smolt	N	211	16.6	29.4	4/25/96	5/19/96	6/11/96
1994	presmolt	N	1,109	5.6	12.7	4/20/96	5/08/96	5/24/96
1994	parr	N	701[e]	2.3	5.6	4/19/96	5/15/96	6/09/96
1993	smolt	N	200	17.0	37.5	5/15/95	6/11/95	7/12/95
1993	smolt	H	499	18.44	39.5	5/04/95	5/14/95	5/28/95
1993	presmolt	N	2,427	5.9	10.0	4/16/95	5/03/95	5/28/95
1993	parr	N	1,569[e]	5.0	8.0	4/20/95	5/10/95	6/10/95
1992	smolt	N	1,931	10.4	19.1	5/04/94	5/29/94	7/22/94
1992	smolt	H	498	16.87	35.7	5/01/94	5/10/94	5/16/94
1992	presmolt	N	4,675	8.8	14.4	4/25/94	5/09/94	6/05/94
1992	parr	N	806[e]	5.0	9.7	4/27/94	5/15/94	6/28/94
1991	smolt	N	171	19.9	38.6	5/15/93	5/25/93	6/15/93
1991	smolt	H	500	22.2	41.2	5/10/93	5/19/93	6/04/93
1991	presmolt	N	695	15.5	22.7	4/25/93	5/09/93	6/07/93
1991	parr	N	1,004[e]	6.9	12.3	4/29/93	5/16/93	6/02/93
Secesh River								
1994	parr	W	571[e]	4.6	9.6	4/14/96	4/25/96	5/29/96

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Secesh River continued.								
1993	parr	W	1549[e]	5.8	10.9	4/14/95	4/30/95	5/24/95
1992	parr	W	422[e]	8.5	11.4	4/22/94	4/26/94	7/11/94
1991	parr	W	327[e]	8.6	13.8	4/27/93	5/01/93	6/24/93
Lake Creek								
1994	parr	W	135[e]	7.4	10.4	4/15/96	4/25/96	5/09/96
1993	parr	W	405[e]	6.4	8.9	4/17/95	5/09/95	6/07/95
1992	parr	W	252[e]	7.1	9.5	4/21/94	4/28/94	5/19/94
1991	parr	W	255[e]	5.5	9.0	4/23/93	4/29/93	6/22/93
Johnson Creek								
1993	parr	W	193	3.6	6.7	4/12/95	6/06/95	7/06/95
1992	parr	W	43	0.0	0.0	--	--	--
1991	parr	W	640	8.4	15.2	4/30/93	5/19/93	6/14/93
Marsh Creek								
1994	smolt	W	3	33.3	33.3	--	--	--
1994	presmolt	W	275	13.1	30.9	4/17/96	4/26/96	5/14/96
1993	smolt	W	220	22.3	40.5	5/09/95	5/27/95	7/09/95
1993	presmolt	W	2,042	23.2	37.2	4/19/95	5/09/95	5/24/95
1993	parr	W	1,576[e]	6.5	10.7	4/17/95	5/09/95	5/24/95
1992	smolt	W	164	8.6	16.7	5/09/94	5/20/94	7/22/94
1992	presmolt	W	6,621	14.8	24.5	4/25/94	5/04/94	5/17/94
1992	parr	W	963[e]	7.8	14.0	4/23/94	5/04/94	5/18/94
1991	smolt	W	173	23.1	42.8	5/14/93	5/31/93	6/17/93
1991	parr	W	1,000[e]	8.2	11.5	4/29/93	5/15/93	5/27/93
Bear Valley Creek								
1993	parr	W	1,455[e]	5.0	9.8	4/28/95	5/18/95	6/12/95
1992	Parr	W	856[e]	9.8	10.8	4/22/94	5/06/94	5/29/94
1991	parr	W	1,015[e]	6.6	17.5	4/29/93	5/16/93	6/22/93
1990	parr	W	1,042[e]	6.6	7.4	4/15/92	5/02/92	5/24/92

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
North Fork Salmon River								
1993	parr	W	520	6.7	11.2	4/20/95	5/01/95	5/15/95
1992	parr	W	314	9.2	12.7	4/22/94	4/27/94	5/07/94
1991	parr	W	513	5.1	8.4	4/25/93	5/06/93	5/15/93
Lemhi River								
1994	smolt	W	42	52.4	71.4	4/22/96	5/02/96	5/14/96
1994	presmolt	W	181	16.6	34.3	4/14/96	4/17/96	4/26/96
1993	smolt	W	198	26.2	56.1	4/17/95	4/29/95	5/14/95
1993	presmolt	N	1,422	21.3	30.9	4/12/95	4/21/95	5/02/95
1992	smolt	N	112	19.6	29.5	4/22/94	5/10/94	7/10/94
1992	presmolt	N	734	12.7	23	4/19/94	4/22/94	4/29/94
1991	smolt	N	286	32.5	55.9	5/03/93	5/15/93	5/26/93
1991	presmolt	N	691	16.1	25.8	4/22/93	4/27/93	5/04/93
Pahsimeroi River								
1994	smolt	N	405[f]	30.4	48.9	6/12/96	7/02/96	7/17/96
1994	presmolt	N	262	11.8	26.3	4/13/96	4/19/96	4/25/96
1993	smolt	N	1,059[f]	23.7	40.0	4/18/95	5/10/95	7/12/95
1993	smolt	H	493[g]	13.0	24.5	4/28/95	5/05/95	5/13/95
1993	smolt	H	572[h]	13.1	25.0	4/29/95	5/09/95	5/22/95
1993	presmolt	N	1,931	16.5	25.1	4/14/95	4/26/95	5/07/95
1993	parr	N	998	9.7	14.4	4/15/95	4/28/95	5/13/95
1992	smolt	N	494[f]	15.2	20.9	4/22/94	5/08/94	7/17/94
1992	smolt	H	998[i]	14.2	22.8	4/25/94	4/29/94	5/09/94
1992	presmolt	N	387	14.7	23.0	4/21/94	4/24/94	5/06/94
1992	Parr	N	130	0.8	11.5	4/21/94	4/26/94	5/04/94
1991	Smolt	N	106[f]	20.8	34.9	4/26/93	6/04/93	7/27/93
1991	Smolt	H	600[j]	22.2	36.7	4/29/93	5/03/93	5/08/93
1991	Smolt	H	71[k]	5.6	9.9	-	-	-
1991	Presmolt	N	450	13.3	20.0	4/22/93	4/28/93	5/12/93
1991	parr	N	482	4.8	7.1	4/21/93	4/30/93	5/08/93

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
East Fork Salmon River[l]								
1994	smolt	N	150	22.0	38	4/20/96	5/03/96	5/20/96
1994	presmolt	N	110	6.4	20	4/20/96	4/22/96	4/25/96
1993	smolt	N	353	22.1	45	5/07/95	5/25/95	6/07/95
1993	smolt	H	499	3.4	6.4	4/29/95	5/06/95	5/13/95
1993	presmolt	N	542	10.5	17	4/17/95	5/02/95	5/16/95
1993	parr	N	498	6.8	12	4/20/95	5/09/95	5/26/95
1992	smolt	N	21	14.3	29	5/09/94	5/10/94	5/10/94
1992	smolt	H	387	1.73	12.4	5/01/94	5/06/94	5/11/94
1992	presmolt	N	198	6.1	12.6	4/23/94	4/26/94	5/03/94
1991	smolt	N	217	21.7	44	5/16/93	5/29/93	6/22/93
1991	smolt	H	350	5.14	8.0	5/05/93	5/10/93	5/26/93
Herd Creek								
1993	parr	W	534	6.7	11.8	4/18/95	5/03/95	5/14/95
1992	parr	W	119	9.2	16.0	4/19/94	4/25/94	5/02/94
1991	parr	W	224	7.1	12.5	4/26/93	4/30/93	5/18/93
West Fork Yankee Fork								
1993	parr	N	171	4	11	5/01/95	5/12/95	5/28/95
1993	presmolt	H	1000	0.1	0.1	6/19/97	6/19/97	6/19/97
Valley Creek								
1993	parr	W	1,522	3.3	6.2	5/04/95	6/02/95	7/08/95
1992	parr	W	855	5.3	10.1	4/24/94	5/04/94	6/03/94
1991	parr	W	1,026	3.1	6.6	4/30/93	5/16/93	6/02/93
Upper Salmon River								
1994	smolt	W	246	26.8	48.4	4/25/96	5/16/96	6/06/96
1994	smolt	H	763	3.15	7.6	4/22/96	4/30/96	5/15/96
1994	smolt	H	76[m]	5.3	6.6	-	-	-
1994	presmolt	W	532	10.5	24.2	4/17/96	4/24/96	5/10/96
1994	parr	W	1,034	5.8	11.0	4/20/96	5/19/96	6/11/96
1993	smolt	W	626	29.1	49.5	5/03/95	5/24/95	6/15/95

Appendix I. Continued.

Stream & Brood Year	Life Stage	Origin[a]	Number Tagged & Released	Detections at Lower Granite Dam (%)	First Detections at Main Observation Sites (%)	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Upper Salmon River continued.								
1993	smolt	H	779	2.44	6.4	5/01/95	5/09/95	5/12/95
1993	presmolt	W	1,135	9.3	14.7	4/17/95	4/30/95	5/24/95
1993	presmolt	H	811	1.60	2.8	4/25/95	4/30/95	5/27/95
1993	parr	W	3,577[n]	3.1	5.3	5/15/95	6/22/95	7/14/95
1992	smolt	W	235	13.2	27.7	4/24/94	5/09/94	5/22/94
1992	smolt	H	562	7.30	12.8	4/28/94	5/05/94	5/10/94
1992	presmolt	W	100	4.0	9.0	4/22/94	4/26/94	5/07/94
1992	parr	W	1,254[o]	3.0	5.9	4/27/94	5/29/94	8/10/94
1991	smolt	W	154	17.5	35.1	5/08/93	5/16/93	6/01/93
1991	smolt	H	800	6.63	12.3	5/11/93	5/24/93	5/31/93
1991	presmolt	W	776	3.7	6.2	4/27/93	5/11/93	5/24/93
1991	presmolt	H[p]	800	5.38	11.0	5/26/93	6/01/93	6/19/93
1991	presmolt	H[q]	800	1.25	1.9	5/20/93	6/02/93	6/22/93
1991	presmolt	H[r]	800	0.88	1.4	4/26/93	5/11/93	5/17/93
1991	parr	W	3,411[s]	4.0	6.8	5/16/93	6/04/93	7/02/93

[a] N = natural, H = hatchery, W = wild
[b] High BKD
[c] Low BKD
[d] Hatchery fish tagged after being caught in screw trap (76 in fall 1992 and 12 in spring 1993)
[e] Tagged by the National Marine Fisheries Service
[f] May consist of more than one year class
[g] Includes BKD fish
[h] Hatchery fish tagged after being caught in screw trap
[i] Total number PIT tagged out of a group of 126,790 fish; of the 126,790 fish, 46,473 were LV clipped (i.e., supplementation fish), but number of LV clipped fish receiving PIT tags is unknown. Thus, we assumed that the detection rate for the whole group is representative of the supplementation fish which were interrogated because their broodstock origin and rearing were identical.
[j] Total number PIT tagged out of a group of 375,000 fish; of the 375,000 fish, 83,953 were LV clipped, but number of LV clipped fish receiving PIT tags is unknown. Thus, we assumed that the detection rate for the whole group is representative of the supplementation fish which were interrogated because their broodstock origin and rearing were identical. This group of 375,000 fish also had whirling disease present.
[k] Hatchery fish tagged at the screw trap
[l] National Marine Fisheries Service data not included in brood years 1991-1993
[m] Hatchery fish tagged after being caught in scoop trap

Appendix I. Continued.

[n] Includes fish from Alturas Lake Creek, Beaver Creek, Frenchman Creek, Huckleberry Creek, and Smiley Creek
[o] Includes fish from Frenchman Creek and Smiley Creek
[p] Low density rearing
[q] Medium density rearing
[r] High density rearing
[s] Includes fish from Alturas Lake Creek, Fourth of July Creek, and Frenchman Creek

Appendix J. Summary of detection rates (minimum survival) and travel time dates to Lower Granite Dam for PIT-tagged chinook salmon. Abbreviations as follows: H-Hatchery, N-natural, W-wild, Cl-Clearwater River Drainage, S-Salmon River Drainage.

	Number Tagged & Released	Detection Rates			Travel Time Dates					
		Median %	25% Quartile	75% Quartile	Median 10%	Min 10%	Max 10%	Median 90%	Min 90%	Max 90%
BY LIFE STAGE AND ORIGIN										
H parr	10090	5	3.6	6.8	4/24	4/12	5/9	6/5	5/9	8/10
N parr	14686	9.6	8.1	11.9	4/24	4/2	5/20	6/8	5/4	7/15
W parr	27602	10.4	7.9	11.7	4/22	4/12	5/16	5/31	5/2	8/10
TOTAL	52378									
H presmolts	8253	4.7	2.4	12.9	4/26	4/21	6/19	6/14	5/17	6/23
N presmolts	32330	20	12.6	23	4/21	4/1	5/7	5/19	4/25	7/14
W presmolts	11662	24.35	13.3	31.8	4/18	4/14	4/27	5/15	4/26	5/24
TOTAL	52245									
H smolts	12844	24.8	10.5	40.8	4/29	4/21	5/11	5/13	5/7	6/4
N smolts	14323	42.35	30.3	48.4	5/7	4/8	6/12	6/22	5/10	8/5
W smolts	2061	41.65	33.8	49.2	5/3	4/17	5/14	6/6	5/14	7/22
TOTAL	29228									
BY BASIN, LIFE STAGE, & ORIGIN										
Cl H parr	10090	5	3.6	6.8	4/24	4/12	5/9	6/5	5/9	8/10
Cl N parr	8327	9.4	8.5	10.5	4/28	4/2	5/20	6/16	5/4	7/15
Cl W parr	0	--	--	--	--	--	--	--	--	--
TOTAL	18417									
Cl H presmolt	4042	12.65	6.2	15.6	4/25	4/21	5/1	6/11	5/20	6/23
Cl N presmolt	16697	19	11.7	22.4	4/22	4/1	5/7	5/29	4/29	7/14
Cl W presmolt	0	--	--	--	--	--	--	--	--	--
TOTAL	20739									
Cl H smolt	4397	42.7	42.1	43.5	4/26	4/21	4/30	5/10	5/7	5/29
Cl N smolt	8607	44.75	40.8	53.9	5/9	4/8	5/27	6/21	5/13	8/5
Cl W smolt	0	--	--	--	--	--	--	--	--	--
TOTAL	13004									

Appendix J. Continued.

	Number Tagged & Released	Detection Rates			Travel Time Dates					
		Median %	25% Quartile	75% Quartile	Median 10%	Min 10%	Max 10%	Median 90%	Min 90%	Max 90%
BY BASIN, LIFE STAGE, & ORIGIN, continued.										
S H parr	0	--	--	--	--	--	--	--	--	--
S N parr	6359	11	8	12	4/21	4/15	5/1	5/28	5/4	6/28
S W parr	27602	10.4	7.9	11.7	4/22	4/12	5/16	5/31	5/2	8/10
TOTAL	33961									
S H presmolt	4211	1.9	1.4	2.8	5/20	4/25	6/19	6/19	5/17	6/22
S N presmolt	15633	21.35	15.1	24.6	4/20	4/12	4/25	5/6	4/25	6/7
S W presmolt	11662	24.35	13.3	31.8	4/18	4/14	4/27	5/15	4/26	5/24
TOTAL	31506									
S H smolt	8447	12.6	7.9	27.7	4/30	4/22	5/11	5/14	5/8	6/4
S N smolt	5716	37.75	29.4	43	5/3	4/18	6/12	7/1	5/10	7/27
S W smolt	2061	41.65	33.8	49.2	5/3	4/17	5/14	6/6	5/14	7/22
TOTAL	16224									

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